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ABSTRACT

Reviewed are empirical studies of relationships among school feeding programs (SFPs), school attendance, enrollment, cognitive development, and academic performance. Recommendations for SFP design are specified. An agenda for a systematic operations research project on the influence of SFPs on these variables and on nutritional status is described. A brief introductory section discusses the background and assumptions of the study. Section 2, which focuses on school attendance and enrollment, reviews retrospective analysis, comparative, and noncomparative studies, as well as studies that identify determinants of school attendance and enrollment, and other relevant studies. Section 3 reviews studies on the relationship between diet and cognitive development, and between SFP participation and cognitive development in developing and industrialized countries. Studies on short- and long-term behavioral effects are also covered. Each study is reviewed in terms of its findings and methodology for the purpose of identifying implications for the design of SFPs and for future research. Section 4 identifies approaches that maximize the educational impact of Agency for International Development-supported school feeding programs. Section 5 outlines an operations research project on the impact of SFPs. (RH)

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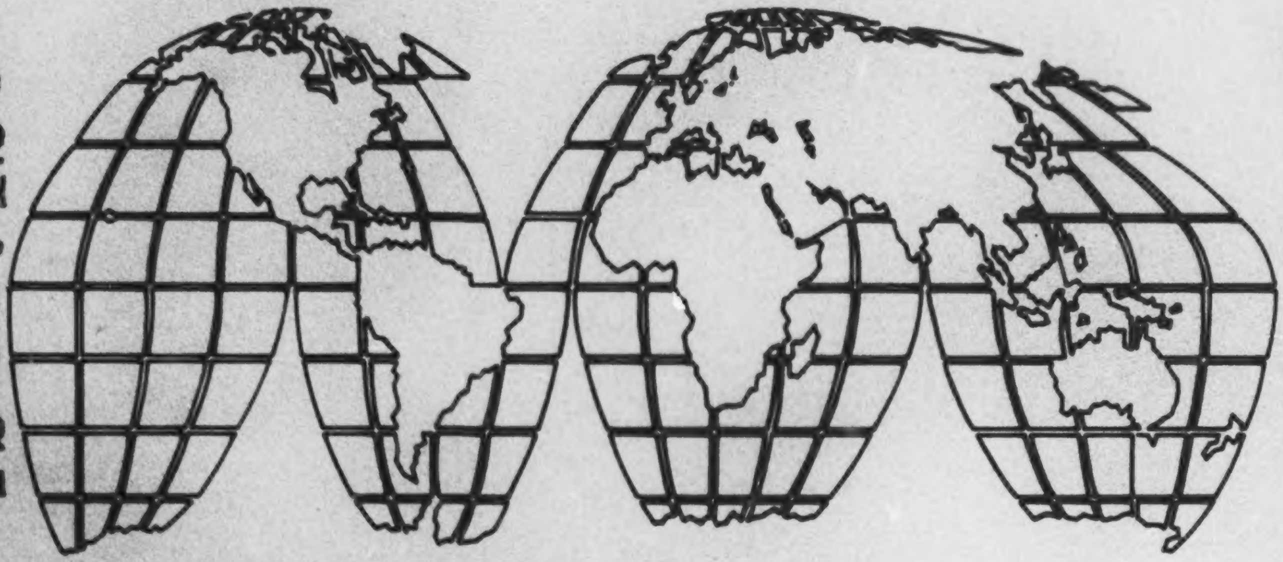

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SCHOOL FEEDING PROGRAMS IN DEVELOPING COUNTRIES: AN ANALYSIS OF ACTUAL AND POTENTIAL IMPACT

AID EVALUATION SPECIAL STUDY NO. 30

by

Beryl Levinger, Ph.D.

U.S. Agency for International Development

January 1986

This report was prepared in collaboration with the Horace Mann-Lincoln Institute of Teachers College, Columbia University under a contract with the Office of Evaluation, Bureau for Food and Voluntary Aid, the Agency for International Development. The views and interpretations expressed in this report are those of the author and should not be attributed to the Agency for International Development.

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Many people helped in the preparation of this study. To thank them all would add considerably to the weight of an already hefty work. However, there are a few individuals whose contributions are so significant that it is impossible to omit mention of them without misrepresenting the origins of this report.

The idea for the study originated with Judith Gilmore and Hope Sukin, both of the evaluation office in the Agency for International Development's (AID's) Bureau for Food and Voluntary Assistance. They identified much of the literature that is reviewed in the body of the text, questioned and probed as needed so that I could sharpen my insights, and were marvelously supportive throughout the project.

This study was undertaken in collaboration with the Horace Mann-Lincoln Institute of Teachers College, Columbia University, where I was employed as senior research associate at the time of its writing. A special thank-you is due to Gary Bridge, Director of the Institute, for enabling me to incorporate the project into my other responsibilities at the Institute and for his guidance in analyzing some of the cognitive development and academic achievement issues discussed in the text. Ron Lane typed and edited the manuscript with superb skill, despite the many demands made by other projects at the Institute. Diane Brede, an Institute research associate, rendered invaluable service by preparing the matrices that appear as appendixes to the study and by assembling the bibliography.

Three other Teachers College colleagues were also most generous with their time and insights. Ann Boehm and Mary Alice White, members of the Psychology Department, were instrumental in helping me to identify procedures that could be used to detect changes in cognitive functioning that might result from participation in school feeding programs. Joan Gussow, a nutrition educator, helped elucidate the linkages among malnutrition, poverty, and school performance.

Last, but not least, are the contributions made by staff members at CARE, Catholic Relief Services, and Checchi and Company. Without their help it would have been impossible for me to gain access to many of the documents so critical to an adequate review of school feeding programs.

While help has come from many sources, the point of view expressed and all recommendations and conclusions are my own. Although this study was produced under a contract with AID's

Bureau of Food and Voluntary Assistance, Office of Evaluation, I received full latitude to praise or damn school feeding programs as the evidence and my inferences would permit. In the end I found neither unfettered praise nor utter damnation to be appropriate. The resultant work, therefore, seeks more to explain and interpret ambiguities than to offer a definitive judgment on the program's worth.

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Assistant Executive Director
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SUMMARY

Three objectives are commonly associated with school feeding programs (SFPs): (1) to increase school enrollment and attendance among school-age children; (2) to improve the nutritional status of children in school; and (3) to improve the cognitive or academic performance of these children. This study examines and assesses empirical evidence regarding the hypothesized relationships among SFPs, school attendance, enrollment, cognitive development, and academic performance. It also uses research findings to derive SFP design recommendations. Finally, the study proposes an agenda for a needed operations research project on how SFPs influence attendance, enrollment, cognitive development, academic performance, and nutritional status.

Four types of studies have been conducted to assess the impact of SFPs on attendance and enrollment: retrospective analyses, comparative studies, noncomparative studies, and studies examining the determinants of school attendance and enrollment. To date, retrospective analyses (of which three are reviewed) have not yielded results in which decision-makers can have confidence. Most fail to use enrollment ratios based on solid demographic data, lack data on contextual variables that might influence school attendance, and do not report longitudinal changes. Because of the inherent weaknesses in this type of study and the inconclusive nature of their findings, they do not lend support for the hypothesized relationships among SFPs, attendance, and enrollment.

Six studies are reviewed that examine the impact of SFPs by comparing data on attendance and enrollment between SFP and non-SFP schools. Most were inconclusive. The evidence suggests, however, that SFPs may be most effective in meeting their attendance-related objective in settings where attendance is not already high and where children come from rural, relatively low socioeconomic backgrounds. Several of the studies also point to the need for program regularity to achieve an impact on children's school-going habits. These findings suggest the importance of targeting practices that take into consideration both need and the probability that program regularity can be maintained.

Eight studies covering eleven different countries examine the impact of SFPs on attendance and enrollment using primarily impressionistic data drawn from teachers. Most of these failed to provide control groups. Significantly, seven of the eight noted a positive programmatic impact on attendance and enrollment, whereas only one drew mixed conclusions. However, their methodological imprecision makes these findings suspect.

Two studies examined how nutritional status influences school attendance and enrollment without specifically assessing the impact of SFPs. In one study (Guatemala), the researchers concluded that when economic and family background factors were held constant, size (a proxy for nutritional status) and health of children acted as independent, positive determinants of both attendance and performance. This study suggests that where SFPs can be designed to have an impact on nutritional status, impacts on attendance and performance will also be achieved. Thus, proper targeting and the provision of an adequate ration become design issues related not only to changes in nutritional status, but to attendance and performance outcomes as well. The second study (Terai, Nepal) reported similar findings; nutritional status contributed positively and significantly to the probability of a child's being enrolled in school. This study also found that the influence of nutritional status variables on enrollment may differ between boys and girls.

The general conclusion one can derive with respect to SFPs, enrollment, and attendance is that feeding programs seem to make a difference when there is a good fit between SFP design and the environment in which the program operates. Judging from the literature, however, this fit is sometimes not present or the evidence to support it is inconclusive. SFP impact appears to be a function of program ecology; nevertheless, crisp guidelines and incontrovertible findings are not available to aid decision-makers in formulating policy for a variety of ecological settings.

This report also examines SFP impact on cognitive development and academic performance in school by reviewing three types of studies: (1) those that are concerned with the relationship between diet and cognitive development in general; (2) those that examine the relationship between SFP participation and cognitive development in developing countries; and (3) those that analyze the relationship between SFP participation and cognitive development in industrialized nations.

Cognitive function may be defined as the ability to learn categories, to process and structure information, and to learn and react to social and environmental cues. Mild to moderate malnutrition, although probably not a cause of primary learning deficits, does appear to alter processes associated with cognitive function. Passivity, apathy, shortened attention span, reduced short-term memory, failure to acclimate to repetitive stimuli, and a lag in the development of sensory-integrative capacity are all associated with mild to moderate malnutrition. These dysfunctions prevent children from taking maximum advantage of their learning environments. Thus, children with protein-caloric malnutrition tend to function at reduced levels of cognitive development and academic achievement. One study, for example, showed that current diet was the single most significant predictor of classroom achievement.

Mild-to-moderate malnutrition acts synergistically with social and environmental factors. The risks for a malnourished child, living in a culture of poverty, are multiple, interactive, and cumulative. However, both human and animal studies show that a developmentally facilitative environment can alleviate the potentially harmful consequences of malnutrition. The consequences are reversible and susceptible to remediation when the child's environment is manipulated to make it more conducive to cognitive growth. Although improvement in the child's diet alone can lead to cognitive changes, greater intellectual growth can be achieved when the child's psychological growth and social environment also are enriched. These findings suggest that SFPs can reach their full potential only when they are designed as part of a broader intervention strategy to address developmental lags or deficiencies in students.

Four studies dealing specifically with the impact of SFPs on cognitive development and academic achievement in developing countries are reviewed in this report. The failure to report baseline data renders two of them inconclusive. The other two suggest that factors exogenous to SFPs exert as much influence on school performance as do feeding programs. Despite this, none of the SFPs reviewed incorporated into its design any feature that might mitigate the impact of these "intervening" factors. A need exists to recast the SFP as a more integrated effort to remedy deficits caused by the interaction among acute malnutrition, hunger, and a developmentally nonfacilitative home environment. The necessity of an integrated approach notwithstanding, the importance of an SFP's impact on the alleviation of hunger and the improvement of nutritional status should not be underestimated. Cotten, in his analysis of an SFP in Haiti, found, for example, that 7 percent of the variance in IQ scores could be explained by malnutrition. He also found that where the quality of education opportunity was low, it was especially important to alleviate hunger for student learning to take place.[1]

Studies on SFPs in this country have tended to look at either short or long-term behavioral effects. Six studies on short-term effects are reviewed in this report. Most emphasize morning feedings and the effects of hunger on classroom behaviors; as a group they yield conflicting results. It should be noted, however, that subjects were not necessarily malnourished. The studies do suggest, however, that the provision of breakfast may benefit students emotionally and enhance their capacity to work on school-type tasks.

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[1] Joel Cotten, "Evaluation Research on the PL 480 Title II School Feeding Program in Haiti" (Port-au-Prince: USAID/Haiti, February, 1982).

Long-term behavioral effects of SFPs were evaluated in five studies. They fail to demonstrate conclusively significant relationships between feeding and school performance. All are marred by serious methodological shortcomings.

Section 4 of this report examines how SFPs can contribute to the improvement of a school system's internal and external efficiency. Particular attention is given to how feeding can become a springboard for cognitively oriented interventions that will allow the SFP to reach its full potential as an intervention strategy designed to have impact on both attendance and academic performance.

The study's concluding section identifies three issues that need to be addressed systematically through an operations research project: (1) What kinds of changes do SFPs promote and for whom? (2) To what extent are those changes interdependent? (3) Given a particular set of ecological conditions, what is the ideal SFP design to promote improvements in enrollment, attendance, and academic achievement? The methodology proposed consists of seven different treatment types (snack only; breakfast only; lunch only; and each of the above meals combined with a cognitive intervention) applied in each of four markedly different ecological settings. One country is recommended as the research site and a 3- to 5-year study duration is proposed. Such a project is needed if the real and potential impact of SFPs is ever to be assessed.

1. INTRODUCTION

Foreign aid is essentially a compromise between the "have" and "have not" countries of the world, a cross between what donor nations are willing or able to provide and what recipient nations actually want. The fit is not always perfect. Bilateral assistance programs, in particular, are as much products of domestic as international economic and political realities. These forces often operate to widen the gap between what developed nations want and what donor nations give. When a program can meet the differing and often conflicting priorities of both sides of the development assistance equation, support for it is almost always broad, deep, and unquestioned. Such a program--representing the essence of positive sum game thinking--responds to the needs of varied and often competing constituencies in ways that are readily perceptible to all.

School feeding programs supported by the Agency for International Development (AID) through its Food for Peace operation appear to be the embodiment of such win-win gamesmanship. They, along with other Food for Peace programs, further the aspirations of an important constituency in America's heartland, the farmer. New markets for surplus products are generated, and domestic price levels for targeted commodities are maintained. Indeed, with the possible exception of aid to Israel, there is probably no U.S. foreign assistance endeavor that generates more sustained or vocal constituent support than Food for Peace. It serves as a cornerstone of both domestic and international U.S. policies, a unique position enjoyed by no other U.S. foreign aid program.

On the other side of the coin are the needs met in developing countries through Food for Peace, Title II of PL 480. These programs are, in a nutshell, politically very popular. Often, they constitute an important, tangible sign that a national government is committed to helping the rural or urban poor. It is widely held that school feeding programs (SFPs) help quench the ever-growing thirst for education (and its attendant benefits) among the poor by removing roadblocks along the path to learning.

Two principal arguments relating to the removal of "roadblocks" have been advanced in behalf of SFPs. First, the provision of a snack or meal serves to increase school attendance and enrollment. Food, in this context, is thus seen as a means to offset some or all of the costs of attending school, including expenditures for books, fees, uniforms, supplies, and transport, as well as a child's foregone earnings. A second argument in support of SFPs is that they improve a child's ability to benefit from instruction by removing hunger or nutritional deficiencies as obstacles to learning. Implicit in this argument is the belief that, by and large, SFPs reach a nutritionally needy segment of the school-age population with a ration that is nutritionally adequate to overcome these needs. The validity of this argument also depends on the strength of the relationship between cognitive functioning and nutritional status.

These arguments lend support for the three objectives most commonly associated with SFPs:

1. To increase school enrollment and attendance among school-age children
2. To improve the nutritional status of children in school
3. To improve the cogitive or academic performance of these children

Yet, SFPs differ from one another in many significant ways. For example, some SFPs provide only a snack, whereas others offer a complete meal. Some rely solely on donated products; others supplement them with locally purchased commodities. Even among programs that offer complete meals, size and composition of ration vary widely. SFPs also differ significantly in terms of the populations they serve. Some reach predominantly malnourished children, whereas others do not. Similarly, some operate in settings where primary school enrollment reaches nearly universal proportions, whereas others are conducted in communities where only a small minority of the population completes 5 or 6 years of school. Given this wide variety of program characteristics and context, it stands to reason that SFPs will vary according to the results they achieve. Indeed, this is the case.

This study is concerned with three issues. First, through a review of the literature, it examines and assesses the empirical evidence that exists to support the hypothesized relationships among SFPs, school attendance, enrollment, and academic performance. Both the relationships and the methodologies used to posit the relationships are scrutinized. Second, it uses this examination of empirical evidence to distill SFP design recommendations for varying contexts. Not all countries face the same problems; nor will the three objectives typically associated with SFPs be weighted equally by all developing countries. Differing weightings and concerns imply variations in program design. Future research needs is the third issue dealt with in this study. Areas in which additional inquiry would be useful are identified, and methodological recommendations for how such work might be conducted are presented.

This study has been shaped by some very important assumptions about SFPs. Foremost among these is that the program has great appeal to a broad range of interest groups in the United States and abroad. In the United States, lay enthusiasm is for the Food for Peace program in general rather than for any of its specific components, whereas in developing countries, SFPs in particular enjoy popularity among parents, planners, and politicians. Such appeal may make it difficult to discontinue SFPs altogether or even significantly reduce support for them unless strong research designs yield incontrovertibly negative findings.

A second assumption about SFPs concerns the range of impacts they might exert. All students of the development process know that any planned intervention brings about a series of secondary changes, only some of which are foreseen. Robert Hanvey has noted that when a change is made within a system, there is no such thing as a side effect, only a surprise effect.[1] In the case of SFPs, the potential for secondary changes is enormous and can influence almost every aspect of the recipient country's social, economic, and political structure. Nevertheless, most researchers have limited themselves to assessing impact in terms of attendance, academic performance, and nutritional status.

Figure 1 illustrates this point by suggesting the kinds of plausible changes SFPs might bring about--either intentionally or unintentionally--in a society's basic structures.

Very few of these plausible relationships are addressed in the literature, and, where mention is made, the data are largely impressionistic. Yet these kinds of relationships--most of which are long term in nature--may exert more influence on the course of a country's development than the short-term causal linkages generally assumed between SFPs and attendance, performance, and nutritional status. Only when retrospective or prospective research is conducted to assess the strength of relationships similar to the ones listed in this section can the merits of SFPs be fully considered.

The remainder of this study is presented in four sections. In the two that follow, topical reviews of the literature on SFPs are presented. Respectively, Sections 2 and 3 single out for special consideration studies examining the impact of SFPs on school attendance and enrollment and cognitive development. Each study is reviewed in terms of its findings and the methodology employed in order to identify implications for the design of SFPs as well as for future research in this area.

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[1] Robert G. Hanvey, An Attainable Global Perspective (New York: Global Perspectives in Education, June 1982).

Figure 1. Hypothetical Consequences of SFPs: Examples of Plausible Relationships

Category of Structural Development	Plausible Change That Could Be Brought About Through the Introduction of an SFP
1. Kinship patterns/ Family relations	There is a persuasive body of literature that suggests that a woman's level of education is the single most important determinant of her fertility behavior. If SFPs could contribute to improved school attendance and enrollment ratios for girls, they might have a long-term impact on family size.
2. Economic activity	Gains in worker productivity in many developing countries can be explained by increases in literacy and school enrollment rates. If SFPs contribute to a reduction in school dropout rates and improvement in attendance and enrollment rates, they might have a long-term impact on the growth of gross national product (GNP).
3. Education-related activity	If SFPs contribute to improvements in academic performance by improving student ability to benefit from classroom instruction, it might be advisable to invest less heavily in in-service teacher training programs and transfer resources to SFPs. This investment pattern might be more cost-effective in the long run because it obviates the need to deal with such persistent teacher-related problems as rapid turnover in rural areas, costly salary stipends for teachers who improve their qualifications through in-service programs, and the need to provide ongoing refresher courses to institutionalize the qualitative changes being introduced through the in-service program. Thus, instead of improving educational efficiency through changes in teacher quality, it might prove more cost-effective to use SFPs to improve student quality.

Figure 1. Hypothetical Consequences of SFPs: Examples of Plausible Relationships (cont.)

Category of Structural Development	Plausible Change That Could Be Brought About Through the Introduction of an SFP
4. Political activity	For a community to obtain an SFP, it first has to achieve a modest degree of organization. Parents may need to band together to exert the political leverage required for their community to be chosen as an SFP site. Once program approval is granted, they must then allocate among themselves such tasks as transporting, preparing, and supplementing the donated commodities. In some cases, they must also work together to build a warehouse, kitchen, or serving area. Such a positive experience in group action might serve as a stimulus for communities to undertake more ambitious projects in response to local priorities and long-term development objectives. It may also reinforce the belief that community organization can lead to concrete benefits.
5. Agricultural activity	SFPs can create new markets for locally produced vegetables. Such expanded demand can come from two sources, SFPs themselves and a secondary market consisting of the families of children who have acquired new food tastes. A new demand for these products may alter the patterns of local agricultural production with either long-run positive or negative effects on farm family income.
6. Health-related activity	If ration size and composition are adequate, SFPs may reduce the vulnerability of school-age children to certain diseases. Local health workers may then be able to allocate an even greater proportion of their resources to prenatal, neonatal, and preschool health concerns.

Although the question of SFP impact on nutritional status is not directly discussed in the main text of this report, two appendixes provide insight into this question. Appendix A summarizes in matrix format key findings, methodologies, strengths, and weaknesses of all major international studies concerned with measuring SFP effectiveness. Data on how SFPs have contributed to nutritional status changes are presented there. Appendix B uses the same format to summarize the conclusions drawn by U.S. researchers in evaluating domestic SFPs.

2. A REVIEW OF THE LITERATURE: SCHOOL ATTENDANCE AND ENROLLMENT

Four principal types of studies have been conducted to assess the impact of SFPs on attendance and enrollment. The first type, retrospective analysis, involves the measurement of changes in school attendance or enrollment when SFPs are temporarily or permanently discontinued. Thus, program presence is treated as the independent variable, with attendance or enrollment considered as the dependent variable. A major weakness of this design is that program suspensions, if perceived as temporary or if passed unnoticed by parents, are not likely to exert the same kind of influence on attendance as total program discontinuation. Indeed, parents may "grin and bear" such short-term interruption of service precisely because they have confidence that the program will be restored.

A second type of study is comparative. School attendance and enrollment data for SFP and non-SFP schools are compared to discern the relative impact of SFPs on the dependent variables. Frequently, the comparison is based on impressionistic data rather than on actual records. Furthermore, the essential fallacy of such studies is the assumption that SFP and non-SFP schools are comparable. Where targeting of schools occurs, it is reasonable to assume major differences between SFP and non-SFP schools in terms of such important determinants of school attendance as socioeconomic status, distance of pupils from school, and teacher quality.

A third type of study is noncomparative. This methodology seeks to gauge the impact of SFPs on attendance and enrollment for a group of schools without the use of controls or comparative frameworks. By and large, studies in this category rely on impressionistic testimony from teachers concerning changes in school attendance. The findings are suspect on a number of grounds. First, respondents might attribute an impact on attendance to the program if they think their responses might in some measure influence the program's continuation. Second, the conventional wisdom is that SFPs affect attendance favorably.

Therefore, teachers commenting on this relationship may not be willing to substitute their own judgment for what they believe ought to happen.

The fourth type of research that has a bearing on the relationship between SFPs and enrollment or attendance does not deal directly with SFPs but rather with an analysis of school attendance or enrollment determinants. In particular, these studies examine the relative impact that such variables as socioeconomic status, verbal functioning, gender, and correlates of nutritional status (primarily height and weight) exert on school enrollment. The reason for including this type of study in a discussion on the relationship between SFPs and attendance is that such research provides two kinds of important insights. First, it sheds light on the extent to which nutritional status influences school enrollment or attendance. If it could be shown, for example, that nutritional status is a critical determinant of attendance, then a logical argument favoring SFPs that are adequate to affect a child's nutritional status could be advanced. Even if other types of studies suggest a negligible or tenuous relationship between SFPs and attendance, a case in support of SFPs might still be made if those SFPs with marginal impact on attendance were also the ones that had marginal impact on nutritional status.

The second set of insights that such studies provide concerns why some children go to school while others do not. School feeding in part represents an income transfer program. The assumption has been that this income transfer might offset some of the costs of schooling. It is further assumed that without such transfer payments, schooling costs might be prohibitive for a targeted segment of the school-age population. The research on determinants of school attendance provides a framework for testing such assumptions.

In organizing a review of literature along topical lines, it is possible to distort the researcher's intention somewhat by implying that the study in question dealt only with the issue under consideration. Frequently, this is not the case. Many of the school attendance studies presented in this section, for example, also examined SFP impact on cognitive or nutritional status. Likewise, some studies that appear methodologically weak with respect to how changes in school attendance were captured may have been much sounder in their approach to measuring changes in nutritional status or cognitive development. Nevertheless, in this section only those research procedures and findings that directly relate to school attendance and enrollment are discussed. Where academic performance impact was also treated systematically, an analysis of the findings and methodology used to derive them appears in Section 3. Readers who wish to have a fuller understanding of each study's scope should consult Appendix A. There, all research questions and findings are summarized for each study listed.

2.1 Retrospective Analysis Studies

Three studies looked at the impact of program disruption or suspension on attendance. One found a positive relationship between SFPs and attendance; the other two reported little clear-cut evidence of significant impact.

The strongest relationship was presented in the 1982 evaluation of the PL 480 Title II program in the Dominican Republic.[1]

In 1962 a school lunch program was initiated in the Dominican Republic under the sponsorship of CARE. By 1978, over 214,000 children throughout the country were being served daily. In that same year, CARE and the Dominican Government began discussions on ways to shift the program away from its almost complete reliance on donated commodities. As a result, in 1979, the Government moved to terminate the CARE-administered PL 480 portion of the school lunch program. However, for a variety of reasons, the planned substitution of locally produced foodstuffs did not occur. The outcome was a sudden termination of a very ambitious supplemental feeding program. Gall and Eckroad examined the impact of this dislocation on primary school enrollment after the school lunch program ended, by using data provided by teachers from Santiago Rodriguez, a relatively poor region in the country's northwest.

The data examined were both impressionistic and quantitative. A sample of teachers of unspecified size provided comments on how they viewed the impact of the program's termination. There seemed to be uniform agreement among teachers that enrollment had been adversely affected. The investigators then examined enrollment records over 11 years for four primary schools in and around Santiago Rodriguez, three of which were small and rural. These records covered an 8-year period when the lunch program functioned and a 3-year period (1980-1982) when it did not. They found that in the 1980-1982 period enrollments had dropped by 23.4 percent. Teachers were then asked about any possible causes of this decrease. They attributed the enrollment decline exclusively to termination of the lunch program. The authors conclude, "In the aggregate, it appears that approximately one-fourth of the children who would otherwise be in school have dropped out."[2]

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[1] Pirie Gall, James Eckroad, and J. David Stanfield, "Final Draft Report: Evaluation of the PL 480 Title II Program in the Dominican Republic" (Annexes), (Washington, D.C. and Ann Arbor, MI: International Science and Technology Institution, Inc., and Community Systems Foundation, August 1982).

The decline in enrollment was lowest for the first grade (17.6 percent) and highest for the sixth grade (29.3 percent). The overall trend toward enrollment decline held for both boys and girls. However, for the lower four grades--the ones most crucial for the development of literacy--female enrollment declined more dramatically than that of males. In the first grade, for example, the termination of the feeding program was accompanied by a 12.5 percent drop in male enrollment compared with 23.3 percent for females. Because more boys than girls had been enrolled in these lower grades, the effects of the school lunch program's termination, according to the authors, were felt disproportionately by girls.

The investigators also compared the enrollment data for the three rural schools in their sample to the urban one. They found an average enrollment decline of 3.1 percent in the rural schools compared with 14.2 percent for the urban school. They concluded that the effects of the program's termination appear to be much greater in rural schools, although for both settings the impact was negative. Furthermore, the differential effects on boys and girls of terminating the lunch program were particularly noteworthy in rural areas. There, in the first grade, for example, female enrollment declined by 43 percent, while the comparable figure for males was only 19 percent. In the urban school, however, the negative effects of the lunch program's termination appeared to be similar for boys and girls.

Because this study is the strongest retrospective analysis in support of a positive relationship between enrollment and SFPs, it is important to assess the methodology used in order to determine how much confidence can be placed in the findings. The most serious limitation is that no demographic data are given for the communities under examination. Did the number of school-age children decline? We do not know. It would have been far more useful to have reported changes in enrollment ratios rather than in the absolute number of children enrolled. Thus, the question of attribution remains largely unresolved. Although we do know that enrollments declined, we do not know whether this was primarily a consequence of SFP discontinuation or any one of several possible changes including out migration, decreases in number of school-age children, economic hardship, parental dissatisfaction with the schools, or the availability of alternative education opportunities. The size of the sample, four schools in one region, does little to diminish concern for the possibility that intervening variables may have confounded the relationship.

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[2] Gall et al., Appendix 15, p.2.

On the other hand, the study offers several potentially important methodological advantages. If the question of attribution were resolved by reporting enrollment ratios and by providing more data on contextual variables that can influence school enrollment, or if we could substantiate that "all other things were equal," the study would make a valuable contribution because it offers the possibility of treating the presence or absence of an SFP as the only dependent variable influencing enrollment. Problems of a control group are obviated, and comparability of data can be assured. Furthermore, because the study deals with program discontinuation rather than a temporary disruption in service, there would be no doubt, if proper care had been taken to account for potential intervening variables, that parental action stemmed from a clearcut understanding of the SFP's future unavailability.

A second retrospective study that examines the impact of SFPs on attendance was done by Drake et al. in 1982.[3] The authors examined retrospective attendance data in Sri Lankan schools to determine the relationship between SFPs and attendance. "Though subject to multiple interpretations, the analysis . . . does point towards a positive relationship between attendance and school feeding."[4] Three strategies were employed to measure the impact of a biscuit distribution program on school attendance.

The first was designed to measure long-term impact by comparing school attendance in the only years during the last 50 when school feeding was discontinued with the attendance when school feeding was resumed. These comparisons did not involve the biscuit program per se but included all school feeding activities. Enrollment ratios were developed by estimating the school-age population from the country's total population and then calculating the proportion of children enrolled by using actual enrollment data. With this approach, they found a clear increase in the enrollment ratio starting in 1957, the year school feeding was resumed. The authors note that they can identify no other variables that can account for this change and therefore suggest that institutional cessation of SFPs seems to induce a decline in school enrollment.

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[3] William D. Drake, et al., Final Report: Nutrition Programs in Sri Lanka Using U.S. Food Aid--An Evaluation of PL 480 Title II Programs (Ann Arbor, MI: Community Systems Foundation, March 20, 1982).

[4] Drake et al., Final Report, p.iii.

A second strategy involved examining the impact on attendance of temporary program suspensions. This involved tracking attendance in several schools before and after a biscuit shortage in 1981 caused by production and distribution problems. For a 3-month period, many districts received no biscuits. Four schools that experienced stoppages were paired with ten that had uninterrupted programs. The authors posited that the schools with interrupted programs would also experience unusually high decreases in attendance. However, when attendance figures were averaged, there was no noticeable drop during the biscuit stoppage. This may have been due to one of two possible causes. A temporary program dislocation may not cause a decline in attendance because children continue coming to school with the expectation that feeding will resume at any moment. Or, it could be that biscuits (as opposed to full lunch programs) are not much of an inducement to come to school and therefore exert relatively little influence on attendance or enrollment figures. It should be noted that the longitudinal study the authors conducted as part of their first strategy did not involve biscuits but some unspecified feeding intervention that may have involved a larger or more economically valuable ration.

The authors also considered comparing enrollment in grades with institutionalized SFPs to those without them. Such a break occurs after the sixth grade, on completion of primary schools. The team did not, however, implement this approach, which would have been questionable, in any case, given the normal decline in enrollment between primary and secondary schools.

The basic weaknesses in the longitudinal portion of this study are the failure to describe the nature of the feeding intervention and the lack of data for any contextual variables that might explain a rise in the enrollment ratio. Such variables might include government campaigns to expand enrollment, overall improved economic conditions, new school construction, general educational reforms that make schooling more attractive, or introduction of innovations designed to increase the absorptive capacity of schools, such as split shifts or increases in the number of teachers hired. It may also be that the investigators misjudged the size of the school-age cohort. Their method for deriving cohort size was to estimate it at 20 percent of the total population. However, Sri Lanka may have experienced, along with many other countries, a postwar baby boom. If so, by 1957, the proportion of the country's population considered of school age would undoubtedly be above the 1952-1956 levels. A failure to note growth in cohort size would have the effect of inflating any enrollment ratio derived from these data.

The major advantage of this longitudinal work is that it did attempt to use enrollment ratios rather than absolute enrollment levels. It would have been helpful to see rural-urban and male-female distinctions made in the data reporting, however. This would have furnished some insight into whether males or females and urban or rural children derive any special benefit from SFPs vis-a-vis attendance or enrollment.

The third retrospective analysis of the impact of SFPs on attendance was conducted in Madhya Pradesh, India by Rewel in 1979.[5] It looked at a lunch program that provided 80 grams of grain, 14 grams of protein, and 7 grams of oil--a total of 312 calories--180 days a year. Impact was evaluated by comparing children with more exposure to the feeding programs with those who had less exposure. The children with relatively less exposure were used, in effect, as a control group. It was hypothesized that attendance in schools with higher efficiency programs would be higher than in low efficiency schools. Efficiency was defined as the total number of feeding days divided by the number of days in the school year. Four efficiency levels were established. The sample included 4,000 children in grades one through five from 409 schools. A three-stage random design was adopted for selecting the children. The food storage point formed the unit of sampling at the first stage, the schools covered by the storage point were the second stage, and children within the schools formed the third stage. Highly inaccessible schools were removed from the sample.

Because of the unavailability of longitudinal information on program efficiency, the schools were grouped de facto at the time of analysis. The cutoff points of the four efficiency groups were defined arbitrarily as low (0-60 percent), medium (61-85 percent), high (86-95 percent), and very high (96 percent and above), so as to have an almost equal number of schools in each group. It should be noted that although the difference in feeding days between high and low program efficiency schools was significant, the high efficiency schools distributed food in excess of the target number of feeding days, while food distribution days in the low efficiency schools were close to the target set for the period. An analysis of children's socioeconomic background showed that the four program efficiency groups were not really comparable. In the "very high efficiency" group, 77 percent came from scheduled castes and tribes compared to 48 percent for the low efficiency group. Furthermore, schools in the low efficiency categories were there primarily as the result of recent interruptions in commodity delivery, an unusual experience for those schools.

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[5] Jack Rewel and Raj Bhatia, Mid-Day Meals Programme: An Evaluation of Impact on Tribal School Children in Madhya Pradesh (India: CARE, 1979).

The data on school enrollment and attendance were obtained from school records. For each school, the number of first graders in a base year was compared to the number of fifth graders 5 years later to derive longitudinal wastage rates. The investigators found no evidence to support the hypothesized impact of program efficiency on school attendance. Indeed, for each of the five primary grades the low efficiency schools had higher rates of attendance than those in the "very high" category.

Linear multiple regression was used to access the relative impact of three factors on attendance: education of father, home caloric intake, and family structure. Relatively little of the variance could be explained this way, perhaps because of the relative homogeneity of the population and the absence of other significant variables (e.g., education of mother). However, when length of participation in the program was factored into the regression analysis, the effect of the other three variables was reduced. In fact, months of program participation seemed to exert the strongest influence on school attendance. An increase of 1 month of program participation, where education of father, family structure, and home caloric intake were taken into account, resulted in an increase of .136 days of school attendance. The authors suggested that this provides empirical justification for the observation that experience with the program and awareness of its benefits are factors that affect parental decisions about a child's school attendance. The effect of socioeconomic status on school attendance was reduced when the total number of months of program participation was included in the regression equation.

The major weaknesses of this study are cited by the author, who notes that the inferences that can be drawn are not clear because of the lack of a control group (an obstacle caused by near universal participation in the SFP by schools in the region) and baseline data. The four program efficiency groups were formulated for comparison purposes by arbitrarily selecting cutoff points. They were not comparable in terms of their socioeconomic status, and the "low efficiency" schools came close to meeting the target number of feeding days. Most had also suffered only recent program disruption; during the bulk of the review period, their programs were operating very regularly. Thus, parents were able to view disruptions as temporary breaks rather than long-term phenomena.

The study is particularly significant, however, for the light it sheds on SFP participation as an independent variable influencing school attendance. The use of multiple regression to explain any variance caused by this variable is appropriate. The findings suggest the need to communicate to parents about program benefits if impact on attendance is an objective.

This review of three retrospective studies suggests that such research, although methodologically promising, has not yet yielded results which decision-makers can use with confidence. In general, they could be improved by incorporating the following features:

-- The use of enrollment ratios based on solid demographic data

-- The presentation of data on contextual variables that might influence school attendance

-- The use of multiple regression to explain any variance in school attendance attributable to contextual variables

-- More attention to parental perceptions concerning the causes and probable duration of program dislocations

-- The use of more longitudinal data

-- The use of multiple sources of data, including children, parents, teachers, and school records

Given the inherent weaknesses and (in two of the cases) inconclusive nature of the findings presented, this type of study does not lend support to the hypothesized relationship between SFPs and attendance. However, retrospective analysis appears to be a promising means of assessing impact because it eliminates the need to withhold food deliberately from a matched sample of schools. And, if contextual variables are measured and adequately accounted for, results should be trustworthy. It should be noted that a variation on a retrospective study would be prospective analysis, in which changes brought about by the introduction (rather than discontinuation) of an SFP are carefully measured and assessed. The same methodological suggestions offered for the design of retrospective studies would also apply to prospective analyses.

2.2 Comparative Studies

Six studies examined the impact of SFPs by comparing data on attendance and enrollment between SFP and non-SFP schools. Most were inconclusive, although the reasons for the lack of clearcut evidence varied.

Both Roy and Rath's evaluation of the school lunch program in Orissa, India[6] and Cotten's work in Haiti[7] suggest positive relationships among SFPs, attendance, and enrollment. However, in both cases, this may have been influenced by the selection of schools for the feeding program.

The Orissa researchers obtained data on enrollment, attendance, and program participation for 23,401 schools from questionnaires mailed to all subinspectors. Enrollment ratios, absenteeism, and dropout rates were compared for schools with feeding programs and those without them. Based on the survey and other official records, the researchers divided the state into the following strata: (1) four predominantly tribal districts in which virtually all accessible schools were in the feeding program, so no comparative sample of schools without SFPs could be drawn; and (2) nine nontribal districts, in which schools with and without SFPs could be selected by random procedures and matched on various criteria.

In the nontribal districts, a related sample of non-SFP schools was selected, matching the village and school on various criteria. These included similarity in size of school (± 20 percent), village population (± 30 percent), and the proportion of cultivators in the village (± 10 percent). Within each school, a random selection of 10 boys from the third and fourth grades combined was made. Inaccessible schools were dropped from the sample.

The basic thrust of the research was to compare a group of children participating in an SFP with a comparable group that was not. Statistical procedures used for this purpose included "t" tests, correlation analysis for item-to-item reliability, Pearsonian correlation to test association between variables, and the chi square goodness of fit test to compare samples on various criteria.

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[6] P. Roy and R.N. Rath, School Lunch in Orissa (New Delhi: Council for Social Development, 1970).

[7] Joel Cotton, Evaluation Research on the PL 480 Title II School Feeding Program in Haiti (Port-au-Prince: USAID Haiti, February 1982).

The authors concluded that the SFP did seem to affect enrollment positively, particularly for lower, primary grades (especially the first) and especially in the tribal areas. They also noted a small decrease in absenteeism for SFP schools; once again this was particularly observable in tribal areas and especially for the first grade. However, only in the upper primary school level of nontribal districts was there *substantially* higher attendance in the SFP than non-SFP schools. Other differences observed in enrollment and attendance, the authors note, could be attributed to the selectivity of the feeding program itself. However, a careful analysis of 3- to 5-year longitudinal data indicated that SFP schools had lower dropout rates, although in the survey year the opposite was true. Where the feeding program had operated more than 300 days in the 2-year period preceeding the study, a decrease in absence in the SFP schools was noted; thus, history of program participation (as in the case of Madhyda Pradesh) seems to explain some variance in attendance.

Three shortcomings in the methodology somewhat mar the usefulness of these findings. First, the enrollment data were reported in terms of the absolute number of enrolled students rather than as enrollment ratios. The authors' conclusions regarding the relatively sanguine impact of the program on students in tribal areas is particularly weakened by the absence of these data. It may well be that such students form a larger cohort in the villages from which favorable data were reported. This same type of failure to report data in relative as well as absolute terms also makes it difficult to assess impact of the program on attendance. The authors note, for example, that although the SFP schools have larger enrollments and actual attendance than the non-SFP schools, there was no significant difference in absenteeism rates between the two types of schools, either by class or for the school as a whole. Nevertheless, they pose most of their discussion and conclusions not in terms of rates but numbers of days present.

A second weakness concerns the construction of the sample and the comparability of SFP and non-SFP schools. The random selection method used a probability in proportion to size procedure. This gave larger schools a higher probability of being selected. Another bias stems from the fact that in the tribal districts, the bigger schools are those with the largest number of nonscheduled caste and nontribal students. By and large, these schools are deliberately not covered by the program. Furthermore, SFP schools have more tribal students and a smaller number of upper caste children than non-SFP schools. This means that either the SFP schools are attracting more tribal students or that the program systematically selects schools with more tribal students. If the latter assumption is indeed the case, attribution to the program of gains in enrollment and attendance by these students may be spurious.

A third limitation of the study is the failure to examine variance in school attendance, enrollment, and dropout rates in terms of socioeconomic status and related variables (e.g., education of father or mother) using multiple regression. This would have strengthened considerably the inference drawn by the investigators that the program exerts relatively more influence on the attendance and enrollment habits of students in tribal areas.

The major strengths of the study include the attempts (if somewhat marred) to use tightly constructed control groups and careful statistical analysis. Another strength in the methodology in the use of "case study" type interviews to probe trends. Thus, for example, a sample of students was asked to explain their days of absence. The use of anecdotal and statistical data provides a potential basis for fresh insights into relationships among the variables. Finally, the focus on examining differential impacts of the SFP is particularly useful and suggests, as in the case of the Dominican Republic study noted earlier, that the impact of an SFP on attendance and enrollment may well be a function of the socioeconomic status of the student population involved.

Cotten's study of an SFP in Haiti is somewhat similar to the Orissa research in terms of the need it manifests for caution in interpreting differences between SFP and non-SFP schools. The evaluation was designed to provide information on program effectiveness and impact. The data base for assessing effectiveness was drawn from a total of 73 SFP schools and 1,422 children. The impact survey, incorporating a more rigorous research design, was limited to the Department of the West, including metropolitan Port-au-Prince. The total sample for the impact study was 54 schools (half with SFPs) and 1,034 children. The data base for both surveys combined included 100 schools and 1,936 primary school children. It should be noted that this study is the first part of a longitudinal research project.

School attendance findings were captured in the impact portion of the research. The author notes that although it would have been preferable to use the actual attendance records of individual respondents, such information was either nonexistent or unreliable. He also found it impossible to restrict the selection of students who met the criteria for age and regular program participation to one grade; thus, records would had to have been obtained from several different teachers, thereby compounding the likelihood of unreliable data.

The investigator therefore opted for a compromise approach whereby the attendance record of a sample of 20 students in the elementary class was used. The average of their attendance was used as the attendance rate for that institution.

Selection of schools for inclusion in the experimental group was based on three criteria. First, the feeding program had to have been in existence for at least 2 previous school years without major interruption. Second, school enrollment had to exceed 100 students to ensure that at least 20 students would fall in the 9- to 11-year-old age group. Third, the schools had to be accessible by four-wheel drive vehicle.

Cotten found significant differences between program and nonprogram children with respect to home environment. On the average, program children came from a better socioeconomic environment. This finding confounds many of the relationships examined, including school attendance. There was a strong correlation between home environment and attendance in both SFP and non-SFP schools. Thus, the investigator concluded that the significant difference between high attendance in program schools and not so high attendance in nonprogram schools could be explained by differences in the home environment as well as by differences in the programs. He suggests that this finding demonstrates that cross-sectional data are not sufficient for measurement of impact; longitudinal studies would be more appropriate.

The Haiti analysis enjoys several noteworthy strengths, including the presentation of a strong conceptual model to explain relationships among dependent and independent variables, the sound use of statistical methods (including multiple regression analysis) to ensure a reasonable interpretation of data, and the forthcoming longitudinal study that will append (and perhaps significantly modify) the findings presented to date.

The conceptual model used sought to establish functional relationships among three sets of variables, x, y, and z, where x and z are independent variables and y represents the dependent variables implied in the following three hypotheses.

H1: SFPs improve the nutritional status of primary school children.

H2: SFPs improve school attendance.

H3: SFPs improve school performance.

The first independent variable, x, is a measure of SFP characteristics; the second, z, measures background or environmental factors generally thought to influence y but which are beyond program control. The research design focused on analyzing each variable in terms of its accuracy and relevance to the research hypotheses and the conceptual model, $y = f(x,z)$. This model yielded the following major variables.

Y1: Nutritional status

Y2: Performance (as measured by Raven test scores)

Y3: Attendance rate

X: Program exposure (as reflected by ration size, length of time in program, computed leakage)

Z: Environmental factors (including measures related to socioeconomic status, quality of instruction, and extra-program eating habits)

The investigator concluded that the best way to determine whether the hypothesized improvements were indeed occurring and attributable to the SFP and not other exogenous factors was to measure relative rates of change in the dependent variables over time in both SFP and non-SFP populations, while controlling for the effects of changes in relevant environmental variables that have a known correlation with variations in the dependent variables. This led to the adoption of a longitudinal research design, only the first phase of which has been completed. The work done thus far in effect serves as a baseline against which future changes will be measured. A chi square test will be used to determine whether the difference between SFP and non-SFP schools, in terms of their "impact" scores, is significant.

Cotten, however, has used the term "significant" in an unusual and somewhat questionable way, accepting a relatively high (20 percent) level of significance when statistical convention dictates a level no higher than 5 percent. At 20 percent, the probability of rejecting the hypothesis that there is no difference between program and nonprogram schools, when in fact it is true, is one in five. Cotten justifies this practice with the following premise: there is reason to believe the program does make a difference and therefore to conclude that the null hypothesis (that the program does not make a difference) is false. Accepting a false null hypothesis could have serious consequences, he argues, if decision-makers were to use such evidence of marginal impact to reduce or terminate the program. Therefore, he selected a low probability of accepting a false null hypothesis (80 percent) by testing at a high level of significance. In other words, he statistically is giving the programs the benefit of the doubt. It would have been preferable to test the conclusiveness of findings at two different levels of significance, .05 and .20, and then offer the necessary data interpretations to aid decision-makers.

Miller's 1982 evaluation of a Sri Lankan school biscuit program's impact on attendance[8] is still another example of the hazards of comparing program and nonprogram schools when in fact they may not be comparable in terms of the socioeconomic status and other educational variables of students that affect school attendance. Attendance rates were calculated for kindergarten through grade five for each month of 1980 in all SFP and non-SFP schools. The attendance in non-SFP schools was higher than for SFP schools in every month. To discover an explanation for this unanticipated finding, Miller disaggregated data by region and grade. His results were still inconclusive. Consequently, a followup questionnaire was administered to principals of schools included in the survey. Preliminary findings suggest that many of the non-SFP schools had been deliberately excluded from the program in 1973, because their students had a relatively high level of nutritional well-being. Furthermore, many of the non-SFP schools were in relatively advantaged urban areas.

This study suggests the methodological difficulties inherent in using comparisons between SFP and non-SFP schools when targeting has occurred and distinctions on the basis of need determine program participation. Because nutritional status is somewhat dependent on socioeconomic status and because school attendance is also influenced by socioeconomic status, comparative studies of this type tend primarily to measure the association between attendance and socioeconomic status. Consequently, statistical methods that enable inferences to be drawn concerning what portion of the variance in attendance is attributable to differences in socioeconomic status and what portion can be explained by SFP participation are especially necessary when targeting on the basis of nutritional need has occurred.

CARE's 1977 study on school feeding in Karnataka, India examined program impact on attendance and enrollment.[9] The state of Karnataka was selected because it had one of the most efficient program delivery systems in India. The researchers, using a circular systematic random method, selected 36 blocks from 20 districts (the sampling frame). In all, data on 4,400 schools were collected, 1,748 of which had SFPs.

For the study on first grade attendance and enrollment, a subsample of 10 percent of the SFP schools (150) and an equal number of non-SFP schools was obtained from block-level education administrators who received monthly attendance and enrollment reports disaggregated by grade for each school. Data were also gathered to study the relationship between the efficiency of food supply and school attendance.

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[8] Roy I. Miller, Internal Report 1: Preliminary Results of School Feeding/Attendance Study: Sri Lanka (Washington, D.C.: USAID, July 2, 1982).

[9] CARE, "School Feeding in Karnataka: Impact on Enrollment and Attendance" (India: CARE, 1977, unpublished report).

A monthly weighted mean for attendance and enrollment was computed for SFP and non-SFP schools. A "t" test was used for comparisons of data between SFP and non-SFP schools. Additionally, the variance of the SFP schools for enrollment, attendance, and attendance rates was compared with non-SFP schools using an "F" test. Program efficiency was determined on the basis of the quantity of commodities actually delivered at the block level compared to estimated requirements for the block. Blocks were then ranked and grouped into quartiles.

The investigators found that schools not participating in the feeding program had higher recorded enrollments. On the average, a total of eight more children were enrolled in the non-SFP schools. No data on socioeconomic characteristics and the size of the school-age population were collected. Therefore, no definite conclusions can be drawn from this finding.

Although more pupils attended non-SFP schools, the proportion of children actually attending class was 3 percent greater in SFP schools. This number rose to 7 percent when first grade attendance rates were compared.

The authors also attribute stabilization of enrollment and attendance figures to the SFP. They report that the variance between the number of children enrolled and those actually attending the SFP schools is significantly lower than in the non-SFP schools. However, this conclusion would be considerably strengthened if specific data on dropout rates were presented.

The investigators also indicate that the regular supply of food commodities is critical in attracting children to the schools. Whereas the SFP schools appeared to attract 3 percent more children than those without the program, this gain rose to 6 percent in the higher efficiency food supply blocks. In comparison, impact on blocks with irregular or occasional delivery was nil. The study suggests that efficiency of delivery must be at least at the 80-percent level for gains to be achieved.

Once again, the usefulness of these findings is weakened by certain failings in the study methodology. First, no discussion is presented concerning the ways in which SFP and non-SFP sites are comparable. What were the criteria used for program selection? If the presence or absence of an SFP the only important difference between the two types of schools? No data were provided to ascertain answers to these questions.

A second shortcoming stems from the failure to explain any environmental or socioeconomic factors that might distinguish low and high efficiency blocks. Perhaps higher efficiency blocks are those located in highly accessible urban areas. If so, differences in attendance may well be a function of rural-urban differences rather than SFP exposure.

Still another weakness is the failure to validate independently the data on attendance supplied by block-level education administrators from teacher-submitted reports. It is quite possible that SFP teachers would inflate these figures if they have been told that the presence of an SFP is supposed to lead to improved attendance.

The study would have been considerably stronger if data on contextual variables were provided, if efficiency had been determined at the individual school level rather than by blocks, and if the impact of the SFP on attendance and enrollment had been analyzed differentially to determine which groups, if any, derive particular benefit from the program. As noted earlier, definitive conclusions about impact on enrollment cannot be derived unless data on enrollment ratios are reported.

A positive contribution of this research is the analysis of SFP impact on attendance variance. It would have been especially useful, however, to examine (other than by grade) the particular types of students for whom attendance was stabilized. Were they primarily rural, scheduled caste, and girls, as other studies suggest? We cannot draw any conclusions from these data.

The 1982 evaluation of PL 480 Title II programs in the Philippines by Blumenfeld poses an interesting context for studying the impact of an SFP on attendance: one where primary school enrollments are already high.[10] In such a setting it can be presumed that parents and students either value education or see some clear benefit stream associated with it. In the Philippines, overall primary school enrollment is between 94 and 97 percent. Under such circumstances it is not likely that an SFP would have a significant impact on overall enrollment, although it might influence the enrollment behavior of particular segments of the school-age population.

Unfortunately, the research team was not able to compare enrollment ratios for SFP and non-SFP schools. Likewise, no longitudinal data were obtained on dropout rates. Days of attendance for two program and two nonprogram schools were compared for 1 school year. No statistically significant differences were found.

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[10] H. Stuart Blumenfeld, PL 480 Title II: A Study of the Impact of a Food Assistance Program in the Philippines (Manila, Philippines: USAID, August 1982).

The investigators did not describe the procedures they used to obtain attendance data nor the statistical tests they applied. It is therefore difficult to provide a suitable methodological critique. The major study weakness, however, is certainly the failure to examine differential impacts of the SFP on particular segments of the school-age population. Some studies, for example, suggest that the attendance rate of the first graders is particularly amenable to an SFP intervention, whereas others take the opposite point of view. However, data were not disaggregated by age, sex, community size, or socioeconomic status. Thus, the potential attendance or enrollment impact of the SFP on those most in need or most underserved by existing government programs is not assessed.

The review of comparative studies on the attendance-related impact of SFPs concludes with what is perhaps the most ambitious and conceptually complex work presented thus far: the 1974-1975 studies by Ellis et al. for Checchi and Company on feeding programs in Colombia,[11] Kenya,[12] and the Philippines.[13] These studies are comparative in two ways. First, they examine the impact of SFPs by comparing SFP to non-SFP schools. However, they also offer cross-national comparisons that shed some light on how the ecology of a program influences impact.

Methodologically, the studies offer what appears to be the soundest approach of the examination of SFP impact, sociological path analysis. This technique is an application of multiple regression. Briefly, the approach calls for the computation of correlation coefficients among all the variables of interest in the evaluation. These coefficients are based on the maximal numbers of cases available and measure simple relationships between pairs of factors. They are then combined into a single measure of project impact through the use of multiple regressions, and yield as an ultimate measure of project effects a statistic known as a beta weight. Technically, this is the standardized partial regression coefficient for the project on an outcome variable, controlling for a package of background and other factors.

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[11] Richard Ellis, Diane Cleemput, and Mark Cooper, Child Feeding Programs in Developing Countries: A Comparative Evaluation of Ongoing Programs in Colombia, Kenya, and the Philippines--Interim Report (Washington, D.C.: Checchi and Company, July 1974).

[12] Richard Ellis, Diane Cleemput, and Mark Cooper, Child Feeding Programs in Developing Countries: A Comparative Evaluation of Ongoing Programs in Colombia, Kenya, and the Philippines, Annex A and B, (Washington, D.C.: Checchi and Company, August 22, 1974).

[13] Richard Ellis, Diane Cleemput, and Mark Cooper, Judging the Merit of Child Feeding: A Development Handbook (Washington, D.C.: Checchi and Company, September 1975).

Beta weights can be interpreted roughly in the same manner as a Pearson product moment correlation coefficient. The direction of the relationship is given by the sign, while its strength is shown by the magnitude of the beta weight. However, the beta weight has a causal implication that the correlation coefficient does not, and it also has no upper or lower bounds.

The researchers examined both SFP and non-SFP schools. Children in the first and third grades were interviewed, measured for height and weight, and tested for scholastic ability. Interviews were held with the children's mothers or guardians, their teachers, and the principals or headmasters of their schools. All field work was carried out in collaboration with host country researchers.

Conceptually, the research team identified three major types of important variables relating to impact: target population traits, program characteristics, and site-related factors. Target population variables include age, social class, and sex. Program characteristics refer to type and amount of ration, extent of commodity shortages or delays in delivery, special features such as the use of prepackaged rations (e.g., Nutribun), quality of local management, and age of program. Site-related variables include climate, geography, local food habits, economy, public health services, local government capability, and other distinctions needed for cross-national comparisons.

The study used the following approach. A sample was drawn of feeding program recipients; another sample of those not reached by the program was also drawn. Extensive data were gathered on the background of all respondents to allow for some of the more obvious sources of differences among these two groups of people. An analysis was conducted of the differences between the two groups (SFP recipients versus nonrecipients) and the program's apparent contribution to those differences. An analysis was also conducted among only those with more rather than less exposure to the program. This was done in recognition of the researchers' probable inability to anticipate every relevant distinction between the two groups.

The research team concluded that if the SFP and non-SFP analysis agreed with the more exposure-less exposure one, they could feel confident about passing judgment on the program. When the analyses were in disagreement, they used other facts at their disposal to see if a sensible interpretation were possible, including a great deal of factual and impressionistic data deliberately sought out for this purpose. These two modes of analysis--SFP versus non-SFP and more exposure versus less exposure--provided the theoretical rationale for three types of summary judgments about feeding programs. Programs were assessed as being one of the following:

1. Effective: Significant net effects were produced according to both modes of analysis.

2. Probably effective: The two analyses did not agree, and additional data were sought to resolve these ambiguities.

3. Ineffective: Neither mode of analysis suggested any impact.

In summary, a child feeding program may look favorable when people in it are compared to those not reached by it. It may also look good by producing evidence of its impact on those who have been in the program for longer periods of time compared with those with less exposure. The researchers believed that they could only be confident of the judgment about a program where both criteria agreed.

These principles were operationalized using the beta weights to derive a comparative ranking of school feeding programs based on the relationship between program exposure and measures of impact. To ensure that conclusions would not be drawn from data that might be substantially trivial or statistically insignificant, all of the associations with a strength of less than +.10 were treated as if they were zero. Any strong negative associations were treated as signs of a badly defective program. In effect, the beta weights reported for school attendance tell the proportion of the variation in attendance patterns of children that can be attributed to feeding, assuming all other factors in the model are held constant. It thus provides a single result based on all available data instead of several results each dependent on particular subgroups. This allows the researcher to work with fewer cases than would be needed for an alternative approach.

Of the 15 programs reviewed by the research team in the three countries noted, 3 were judged as "effective on attendance" and 10 were considered "probably effective on attendance." The remaining two were assessed as "ineffective on attendance."

Three other measures of impact were also used in the study: nutritional status (weight for height), school performance, and food habits. Of the four measures of impact, the SFPs had their most pronounced effective on school attendance. Four schools, however, showed negative results when comparisons were made with control schools, but this was primarily due to very high attendance rates at those sites. School attendance there averaged about 98 percent, making it nearly impossible for the program schools to do any better.

Comments by principals concerning attendance tended to concur with the objective data. Nearly all said they thought the SFP encouraged children to come to school daily. Furthermore, some said that the food also encouraged children to stay for the afternoon session instead of leaving at midday.

In all three countries, teachers had mixed reactions when asked about the ability of the SFP to attract children. Many said that attendance was already good and that the SFP's impact was therefore small. In Kenya, third grade teachers noted some effect, while first grade teachers saw no impact. The authors suggest that this may well be a function of greater attendance problems for older children. In Columbia, where school attendance was already fairly high, it was inferred that pressing reasons account for those who do not attend regularly, particularly the need for child labor. These observations led the authors to conclude that it may be difficult for such incentives as low-cost lunches to make a significant difference in Colombian school attendance. In the Philippines, they note, where formal education is probably more greatly valued than in the other two countries, school attendance was already very high, making it difficult for an SFP to have much of a general impact. In the case of Kenya, school attendance was lower overall than in the other two countries; however, they assume that the use of school fees there (a practice since dropped) meant that the financial burden of attending school probably outweighed the value of the food incentive.

Retrospective attendance records for the 6-year period (1968-1973) were obtained from principals at each school. In most cases, no clear pattern of effects showed up when comparisons were made before and after initiation of the SFP. However, three of the schools did show favorable results when compared with the respective control schools over the 6-year period. All three also looked favorable on the basis of the survey analysis.

The researchers' approach to measuring attendance encompassed initial enrollment, dropouts, and daily attendance. Of the three, they found that daily attendance provided the most reliable information, whereas enrollment and dropout data were difficult or in some places impossible to obtain.

Daily attendance was measured in two ways. First, data obtained from teachers' records for the number of days individual students attended school for the 1-month period prior to the survey were calculated as a percentage of the total number of school days during the same period. This provided a measure of each child's current propensity to attend school. Reasons for absences and distances to schools, as reported by children and their mothers, were also recorded. Second, the longitudinal information previously noted was obtained from principals who were asked to provide records for the last 6 years of average annual school attendance and enrollment, by grade levels. This provided a measure of propensity to attend for each cohort (grade) over a 6-year period.

The researchers felt that the measurement of enrollment effects demanded the gathering of data on potential enrollments so that these could be related to actual enrollments. These data proved to be impossible to obtain, however, in all three countries. Problems of defining school "districts," estimating school-age populations, estimating school capacities, and knowing enrollments of other schools within the same geographic area were insurmountable obstacles.

The team sought to draw conclusions about those traits that tended to characterize the more effective programs. Among the variables they examined were the type of feeding, the age of the program, how high food fees were, frequency of interruptions to the program, whether food was taken home, how many days per year the food was served, the sponsoring agency, and annual estimates of per-recipient costs. Of all these characteristics, they found several that seemed to distinguish the more effective operations, where "effectiveness" refers not only to school attendance but also nutritional status, school performance, and food habits (as measured through a student 24-hour recall survey). These traits include (a) selectivity within the school as to which children are eligible to receive the food; (b) having a large number of feeding days per year and few feeding interruptions; (c) having hot lunches as opposed to other forms of feeding; and (d) having less food taken home.

Equally noteworthy are the factors that did not seem to make much of a difference: the age of the programs, the food fees, program sponsor, or costs. The researchers' finding that selectivity within the school makes a difference stems mainly from the variations in nutritional status among children rather than differences in attendance. If everyone at school receives an SFP-lunch, then both the more and less healthy students get fed. The effect of the program is then muted because it is more difficult to bestow nutritional status benefits on relatively healthy children. However, this finding appears to be applicable to the nutritional status objective rather than to attendance.

The authors note that, in general, SFPs must be very carefully targeted. Their data suggest that programs are more effective in stable, poorer, rural areas. They attribute this to the fact that in such zones, SFPs may be a relatively greater incentive for increased attendance. A strong structural effect can operate in school programs, they surmise, so that a population of those on the borderline of their own development scale--the poorer people among those who are able to send children to school--are especially likely to benefit. They also found that the best predictor of student attendance was household possessions. Children from the better-off homes attended most frequently. This provides additional support for the notion that economically borderline children may appear to derive the most benefit from SFPs. Interestingly, the next most potent predictor for attendance was nutritional status which, of course, was intended to be influenced by the SFP. It appears that when SFPs can affect nutritional status, a useful synergy is created so that attendance benefits are also produced.

One of the most provocative insights from these studies is the notion that models of working feeding programs implicitly reflect a program planner's conceptions about the way an SPF should function. If this is the case, then ineffectiveness is probably due to a lack of fit between the assumptions inherent in the design of the effort and the actual conditions found in the field. The use of path analysis provides a means to test this reasoning by examing where the largest number of "incorrect paths"--a shorthand term for unanticipated cause-and-effect linkages--appears. In this three-country SFP analysis, Colombia showed the greatest number of "incorrect" paths, while Kenya showed the least. This led the investigators to conclude that the theoretical model for school feeding is better suited to less developed areas.

The major strengths of this work include the following:

-- The use of multiple sources of data. Survey research and analysis of retrospective records were incorporated into the study design. Interviews with children, their mothers, teachers, and principals permitted access to both factual and impressionistic data.

-- The collaboration with host country researchers in each of the three field sites.

-- The use of a conceptual model together with appropriate statistical methods to facilitate identification of causal linkages and important ecological considerations related to program effectiveness. Path analysis allowed the researchers to assess the relative impact of a complex package of variables on attendance. The methodology also enabled the researchers to account for sources of differences among programs, sites, and participants.

- The use of multiple attendance measures. Data were gathered to determine the child's current propensity as well as the cohort's longitudinal propensity to attend school.
- The use of two different modes of analysis to assess effectiveness. Comparisons were made between the SFP recipients versus the nonrecipients and those with more exposure to the program versus those with less exposure. Only when agreement between these two levels of analysis was obtained did the program receive an "effective" rating. When a beta weight above +.10 was obtained on one but not both measures, additional impressionistic data were gathered and a "probably effective" rating was assigned.

In light of this impressive array of strengths, it is especially important to note the study's weaknesses. These include the following:

- Failure to examine differential impacts within schools for boys versus girls, more distant versus less distant students, and younger versus older children
- Relatively small number of SFP sites (five) in each country
- Lack of a satisfactory solution to the problem of gathering enrollment ratio data
- Failure to take seasonal variation in attendance patterns into consideration
- Incomplete explanation of the specific criteria and processes used in selecting the control sites
- Predominantly cross-sectional nature of the data, which consequently fails to provide any insight into longitudinal changes

It should be noted that Cotten's analysis of the SFP in Haiti discussed earlier in this section is, in large measure, an attempt to address the latter shortcoming by applying much of the methodology used by the Checchi team in a longitudinal fashion. This work by Cotten points up the Checchi study's greatest strength: the applicability of its basic methodology to new inquiries on the impact of SFPs. As the number of applications of this methodology grows, a more fruitful body of literature on the topic will undoubtedly emerge.

What, then, can we conclude from the six comparative studies reviewed here? Together, the accumulated research suggests that SFPs may be most effective in meeting their attendance-related objective in settings where attendance is not already high and where children come from relatively low socioeconomic backgrounds. In such cases, feeding programs may indeed be an incentive. Several of the studies also point to the need for program regularity to achieve an impact on children's school-going habits. These findings have serious implications for targeting both for need and for the probability that program regularity can be maintained.

In general, the methods used in the Checchi team's work can and should be applied to other comparative studies, although provision to address the weaknesses noted earlier should be made.

Other broad guidelines for conducting comparative studies to assess the impact of SFPs on attendance and enrollment include the following:

1. The ration size served at the actual sites under analysis should be determined, and the impact of alternative ration sizes should be assessed. The impact of snack versus hot lunch programs should also be measured more systematically.

2. Tested, culturally relevant and observable indicators of family and community background must be incorporated into the study design. These are especially important in comparative studies so that the interpretation of differences between SFP and non-SFP schools occurs within the appropriate context. Such differences must be systematically introduced into the analysis along with the many socioeconomic factors that might influence attendance.

3. Survey instruments should be used that are relatively short and simple. It is clearly preferable to work with a small number of well-measured variables than many variables captured unreliably or invalidly. Multiple sources of data also enhance the measurement of key variables.

4. A variety of sites and settings within a country should be evaluated so that a realistic picture of how the program operates can be obtained.

5. Quality controls for record-keeping systems should be developed and installed so that attendance and program participation data are useful.

6. A longitudinal or time dimension should be incorporated into study design through repetitive site or cohort measurements.

7. The total number of months during which the individual has actually been participating in the SFP should be determined.

8. Suitable methods for calculating enrollment ratios must be devised. This involves primarily a procedure for assessing cohort size. Local birth rates as captured through church records, birth certificates, or interviews with midwives and clinic personnel could be discounted by reasonable estimates of infant mortality rates and outmigration patterns. Or, alternatively, a household sampling procedure might be used. School districts could be empirically set by using mapping techniques to define the geographic area from which the school has drawn students over a 5-year period.

9. The differential impacts of SFPs should be included in any assessment of program effectiveness. In particular, analysis should focus on whether girls proportionately derive any special benefit. If, for example, SFPs act as a greater incentive for girls to enroll and attend, this finding may have significant implications for population programs. This is because of the strong positive relationship that normally exists in developing countries between a woman's education and her fertility rate. Likewise, given the very strong positive relationship that also normally exists between a woman's education and the educational attainment of her children, special impact on girls may have long-term, cross-generational significance for future enrollment ratios and attendance rates.

10. Care should be taken in selecting an appropriate level of significance to measure differences between SFP and non-SFP schools. The need to guard against accepting the false null hypothesis (the case where researchers conclude that the program makes no difference when indeed it does) must be weighed against the need to accept the null hypothesis when it is true (the case where researchers conclude the program makes no difference and, in fact, this is precisely the case). Using more than one level of significance for interpreting findings may be helpful in this regard. Where findings are significant at both the .20 and .05 levels, there can be little doubt about their validity. Yet, a finding significant only at the .20 level may be justifiably (albeit tentatively) accepted if impressionistic data gathered from interviews and observations suggest that a program ought to be given the benefit of the doubt. Re-evaluation of longitudinal assessment should be conducted, however, to clear up these ambiguities over time.

11. The impact of SFPs on attendance and enrollment cannot be completely measured without longitudinal data on dropout rates. If such programs reduce the variance for attendance and help stabilize enrollment (as suggested by some of the research), we should expect to see a change in dropout rates as well.

Because school desertion is one of the greatest obstacles to the efficient functioning of educational systems, this potential benefit from SFPs needs to be examined most carefully.

12. The contextual factors that contribute to program regularity need to be identified and accounted for in future research efforts, perhaps through multiple regression procedures. Urban areas, for example, may be more likely to have efficient programs because of their accessibility. Schools in urban areas may also attract relatively better-off students than schools in rural, deprived areas with inefficient programs. Thus, impact differences between regular and irregular programs may be related less to efficiency than socioeconomic status.

In summary, comparative studies such as those conducted by Checchi and Company hold out the promise of an increased understanding of what makes programs work in a variety of settings. However, the design of these studies must be based on a thorough understanding of both the differences and the similarities among the sites being compared. Where resources do not allow for such differences to be accounted for through fairly complex statistical procedures, retrospective or prospective analyses are probably preferable.

2.3 Noncomparative Studies

Eight studies covering 11 different countries examined the impact of SFPs on attendance and enrollment using primarily impressionistic data drawn from teachers. Most of these studies failed to provide systematically for control groups. Likewise, data are neither retrospective nor longitudinal. The major contribution of these studies, consequently, is limited to what they have to say about the conventional wisdom concerning SFPs rather than the insights they contain regarding methodology or impact. Significantly, seven of the eight noted a positive programmatic impact on attendance and enrollment, whereas only one drew mixed conclusions. Because of their methodological imprecision, they are given relatively cursory review here.

In 1981, the Food for Peace program in Ghana was evaluated by a team, including members from Development Associates, Inc., USAID/Ghana, the Ghanaian Ministry of Health, and several nutritionists serving as consultants.[14] Included in their study were 11 SFPs. Program managers and teachers reported that more children attended when there were meals and that illness was lower. They also felt children were able to pay greater attention to their lessons, thus facilitating learning. Teachers often noted that many of the children came to school without breakfast and that without the lunch it would be difficult for them to study.

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[14] Earl Jones et al., Evaluation of Title II: Food for Peace in Ghana (Washington, D.C.: Development Associates, Inc., September 1981).

Sites were selected to approximate proportionate stratifications based on political region, rural-urbal differences, program type, sponsoring agency, and number of recipients. Three weeks were spent in the field. All data relating to attendance and enrollment were gathered through interviews of school personnel only.

Gorecki's 1978 study of an SFP in Honduras presents conclusions that are similar to those for Ghana in both their nature and derivation.[15] She reported that 97 percent of the 53 teachers interviewed agreed with the proposition that school snacks increased attendance. It should be noted, however, that all teachers stated that, in general, morning attendance was always higher than in the afternoon, with or without a snack program. The majority also believed that the snack was often the child's first meal of the day, especially among poorer families. Another prevalent teacher opinion was that the children slowed down in the mid-morning and that the snack helped increase their attention span.

The sample for this study was divided into large and small schools, using an enrollment of 100 as the dividing point. This was done to increase the chances of selection for the larger, often urban schools. In total, 21 schools were surveyed.

The 1977 study done by Clapp and Mayne, Inc. on the SFP in Honduras coincides with Gorecki's findings.[16] Means to assess impact on attendance included the review of subjective opinions expressed by teachers, an analysis of school attendance on the morning and afternoon sessions for given days, and a before-after comparison of schools with and without an SFP.

The researchers found that 73 percent of the 51 teachers believed that SFPs were instrumental in stimulating better attendance at school. Several respondents noted that there was better attendance in the morning, when the food was served, than in the afternoon. The supporting data with respect to this observation, however, were drawn from only two schools and are inconclusive.

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[15] Margaret Gorecki, "Nutritional Evaluation of the School Feeding Program, Preliminary Report--Honduras," (Honduras: CARE, June 9, 1978, unpublished report).

[16] Clapp and Mayne Inc., Evaluation of PL 480 Title II Feeding Programs in Honduras (San Juan, Puerto Rico: Clapp and Mayne, Inc., 1977).

In terms of a direct impact of the meal on attendance, the team secured one example of a school where the SFP had been introduced and then discontinued, and another where the program had begun only the year before. In the first instance, attendance appeared to increase and then drop again. In the other, enrollment increased from 276 to 320 when the SFP was introduced.

None of the findings presented in the report was supported by statistically valid sampling procedures and an adequate number of cases. Virtually all potentially intervening variables are not accounted for in the research design.

Three studies evaluated the impact of SFPs on attendance and enrollment in India.[17,18,19] They all involved the collection of impressionistic data and the analysis of qualitative aspects of the program. All likewise concurred that SFP positively influenced enrollment and attendance. One of the studies, for example, found that 73 percent of the teachers surveyed believed the program led to increased enrollment or attendance.[20] Another reported that all subjects interviewed --including governmental officials, CARE personnel, teachers and parents--believed that the food served as an attendance incentive for both children and their parents.[21]

The 1981 evaluation of Food for Peace programs in Upper Volta also included information on school enrollments and absenteeism drawn from interviews with school directors.[22] The authors report that at many schools the directors felt that the SFP provided an important motivation for attendance. However, at several others, the directors said the desire for

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[17] CARE, An Evaluation of the School Feeding Program in India (India: CARE, July 1975).

[18] CARE, Mid-Day Meals Programme in Madhya Pradesh; A Study of Impact on Tribal School Children (New Delhi: CARE, 1979).

[19] Community Systems Foundation, Final Report: Analysis of Community Level Nutrition Programs in India (Ann Arbor, Michigan: Community Systems Foundation, October 1980).

[20] CARE, Mid-Day Meals Programme.

[21] Community Systems Foundation.

[22] International Science and Technology Institute, Inc., "Upper Volta Food for Peace/Title II Evaluation Final Report" (Washington, D.C.: AID Office of Food for Peace, September 1981 unpublished report for USAID).

schooling was high and attendance was good even without the additional incentive of a school lunch. Teachers also reported that the program improved children's attention span, especially in the afternoon. Although there is little hard evidence in support of the program's impact, the school directors' remarks about the marginality of the program when attendance is already high is consistent with the findings of Blumenfeld for the Philippines and the Checchi three-country survey.

An eight-country global assessment of the Food for Peace programs of Colombia, the Dominican Republic, Ghana, Indonesia, Malaysia, Morocco, the Philippines, and Sri Lanka was undertaken by Checchi and Company in 1972.[23] With respect to SFPs, the researchers found that there was little conclusive evidence to support the notion that the programs have a long-term positive impact on nutritional status, learning receptivity, or attendance of children who are in school. In the eight countries sampled, the only evidence available to the team was in the form of teacher judgment. Most respondents reported that children appeared to be more alert or active when they received a meal or snack. The authors rightfully note, however, that more research is necessary before any positive correlation between SFPs and improved attendance or performance can be made. This judgment is based not on the presence of contradictory data, but on the lack of firm support for the program's hypotheses.

2.4 Determinants of School Attendance and Enrollment Studies

Unlike the other research reviewed thus far, the two studies included here do not deal specifically with the impact of SFPs. Rather, they represent an attempt to examine the interrelationships among a wide variety of socioeconomic status-related variables. Included in the analyses are important insights into why some children are likelier than others to attend school. They also deal very specifically with how school enrollment is influenced by nutritional status.

Balderston et al. describe the findings of the Berkeley Project on Education and Nutrition.[24] The overall work, published in 1981, presents findings on (1) the effects of nutrition and health on school participation and performance,

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[23] Checchi and Company, Food for Peace--An Evaluation of PL 480 Title II: Vol II--Evaluations of Eight Country Programs (Washington, D.C.: Checchi and Company, July 1971).

[24] Judith Balderston, et al., Malnourished Children of the Rural Poor (Boston: Auburn House Publishing Company, 1981).

(2) the relationship between literacy and agricultural productivity, and (3) the relationship between women's education and family size. The data base for these analyses came from two related research projects. The first was a longitudinal study done by the Institute for Nutrition in Central America and Panama (INCAP) and funded by the National Institute of Child Health and Human Development between 1969 and 1978. The other was done by RAND (through Rockefeller Foundation funding) in 1974-1975. The earlier projects involved the collection of data in four eastern Guatemalan villages on physiological, nutritional, socioeconomic, and psychological variables, where particular attention was paid to interactions among types of variables. The Berkeley team used the wealth of material amassed to conduct additional analytical studies.

The investigators found that in Guatemala, decisions to enroll a child in school appear to be affected by parents' need for the child's help, by parental perceptions concerning the value of schooling, and by the child's apparent competence. In the one village where work for children was readily available and where parents' educational background was relatively low, school enrollment was affected positively by family affluence but not by apparent differences in the child's weight, height, or verbal proficiency. In the other villages, where parents had relatively more education and work was not so readily available for children, the factors of height and verbal performance at age 7 were positively and highly significantly related to school enrollment.

When family economic groups were separated, it was found that for children of semi-subsistence farming families decisions on enrollment appear to be positively determined by affluence of parents, size of child, and by the child's position in the family. Children born earlier in the family order were more likely to attend school than those with older siblings. In general, the researchers concluded that when economic and family background factors were held constant, size and health of children acted as independent, positive determinants of children's school attendance and performance. Size of child is, in effect, a proxy for prior nutrition.

There are several implications of these findings for SFP design. First, it seems likely that where the need for child labor and availability of employment opportunities for children coexist, SFPs are likely to act as incentives for school attendance only when the ration size is large enough that feeding can be viewed by parents as a significant income-transfer program. In such circumstances, it might even be desirable for children to take part of the ration home.

Second, the impact of any SFP seems to be a function of an interaction between the environment in which it operates and the features incorporated into its design. To have an impact on attendance or enrollment in a very impoverished community, an SFP must incorporate special design features that may not be needed for a borderline one. Once a threshold is crossed (as in the case of Colombia or the Philippines), impact on enrollment or attendance is likely to be relatively small.

Third, the Berkeley team found very different patterns of school enrollment for boys and girls. Girls' work in the household was highly valued and therefore served as a significant disincentive to school enrollment. This tends to suggest, once again, the need to look at differential impacts of SFPs on attendance of boys and girls. Even relatively small overall enrollment gains may be highly significant if new female enrollment accounts for much of the change.

Finally, the finding that children's size and health act as independent, positive determinants of children's school attendance and performance has important ramifications for SFPs. Because size is a proxy for nutritional status, this suggests that if SFPs can be designed to have an impact on nutritional status, impact on attendance and performance will also be achieved. Thus, proper targeting and the provision of an adequate ration size become design issues related not only to changes in nutritional status, but to attendance and performance outcomes as well.

A second study to demonstrate the negative effects of malnutrition on school enrollment and grade attainment is Moock and Leslie's 1982 work in the Terai region of Nepal.[25] Their research involved a population of approximately 400 school-age children from subsistence farm families as part of a followup study initiated by the World Bank to investigate the relationship between schooling and various dimensions of rural development. Earlier research by Jamison and Lockheed (1981) found that important determinants of school enrollment were sex (with boys much more likely to enroll), caste, parental schooling, and the presence of "modern" attitudes.

With respect to school enrollment, the purpose of the analysis was to determine how individual, parental, household, and community variables affect the probability of a child's being enrolled in school. The researchers found that older children were significantly more likely than younger children to be in school. Both height for age and weight for height (but not a third nutritional status variable, hemoglobin level) also contributed positively and significantly to the probability of a child's being enrolled in school. Height for age, a measure of chronic malnutrition, appeared to be a better predictor than weight for height, a measure of acute malnutrition and, in fact, was the best single predictor of whether or not a child was enrolled in school. The influence of the nutritional status variables appeared to be greater for boys than for girls.[26]

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[25] Peter Moock and Joanne Leslie, Childhood Malnutrition and Schooling in the Terai Region of Nepal (Washington, D.C.: International Bank for Reconstruction and Development, 1983).

The statistical relationship between nutritional status and enrollment remained strong when additional variables were entered into the analysis as controls. Four background variables were also found to have significant direct effects on the probability of a child's enrollment in school: father's schooling, farm size, income from rice and wheat, and membership in a low-status caste. Farm size exerted a negative influence that seemed to be greater for children whose height for age fell in the normal range than for stunted children whose potential contribution to farm production is probably smaller.

These findings are consistent with those of the Berkeley team. Once again, the need emerges for an SFP to be both an effective income-transfer scheme and sufficiently nutritious that it influences weight for height and height for age measurements.

Moock and Leslie note that the importance of height as a determinant of school enrollment and performance depends on the general level of nutrition in the population. In an impoverished environment, height is a good indicator of an individual's long-term nutritional status.

This study, along with the Berkeley work, adds to the evidence supporting the view that efforts to improve child nutritional status may have educational as well as survival and health benefits. The implication for SFP design is that programs that are most effective in improving nutritional status are also most likely to be effective in improving enrollment and attendance.

2.5 Other Relevant Studies: The United States

To conclude this literature review on the impact of SFPs on school enrollment and attendance, three studies conducted in the United States will be noted briefly. All three found no positive relationship between feeding and attendance or enrollment. Their inclusion here is mainly to highlight the breadth and scope of research in this field as well as to emphasize again the need for appropriate targeting, longitudinal research, and care in reaching judgments about program effectiveness based on incomplete or inadequate comparisons.

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[26] Cited in Moock and Leslie.

Lieberman's 1967 evaluation of a ghetto school breakfast program involved a comparison between two adjacent elementary schools, only one of which had an SFP.[27] Interviews were held to gather dietary and social data, and student attendance and performance records were reviewed. In addition, physical, anthropometric, and psychological tests were conducted on the sample, which included third through sixth graders. Lieberman's major findings can be summarized as follows: (1) average nutrient intake as reported by students was similar at both schools; (2) there were no significant differences in student height and weight between the two schools; (3) no significant differences in attendance existed between the two schools; and (4) no significant differences in student performance existed between the two schools.

Although this work was longitudinal, the time span was probably too short to detect any program effect. Much more significant, however, is the fact that the program was not serving students who showed signs of malnutrition. This inadequate targeting undoubtedly influenced impact. Furthermore, the researcher did not attempt to control for student participation in other SFPs available at the same site, thereby making it difficult to generalize from these research results.

Fellers' 1967 research examined the effect of school breakfast programs on school grades and dropout rates.[28] Participants and nonparticipants were found to have similar final grades and no differences in dropout rates. The sample included 198 participants and nonparticipants drawn from the tenth grade of one school. At the end of the school year, a comparison of grades and dropout rates was made. The methodology did not control for program exposure (no records were kept on the number of servings received by each child), although it was clear that not all children participated equally. Furthermore, data drawn over the course of 1 school year seemed inadequate when gauging dropout behaviors.

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[27] Harry Lieberman et al., "Evaluation of a Ghetto School Breakfast Program," Journal of the American Dietary Association 68 (February 1976):132-138.

[28] Cited in Kathryn Nelson et al., (eds.), The National Evaluation of School Nutrition Programs, Vols. I & II (Santa Monica, California: Systems Development Corporation, April 1981) (report for USDA); and in Ernest Pollitt, Mitchell Gersovitz, and Marita Garguilo, "Educational Benefits of the United States School Feeding Program: A Critical Review of the Literature," American Journal of Public Health 68 (May 1978) 471-481.

A different kind of comparison was undertaken by Koonce in 1972 in attempting to detect differences between children who received both breakfast and lunch at school and those who were served only lunch.[29] Children who participated in neither program were also included. The sample included 60 children from first to third grades. The attendance proportion of the study involved the review of school records. No difference was found with respect to absenteeism when the two participating groups were compared with each other and with nonparticipating students. The researcher, however, did not control for frequency of program participation and limited the study to a very small number of subjects. Furthermore, data on attendance was drawn over a 3-month period, which may be too short to capture attendance trends.

In summary, the three studies cited here capture some of the methodological problems inherent in examining the attendance- and enrollment-related impacts of school feeding: the need to control for program exposure, socioeconomic status, and seasonal variations, as well as the difficulty of discerning long-term effects (particularly on dropout rates) without longitudinal data. As a result, their findings must be treated as inconclusive. They do tend, however, to support the observation advanced by Checchi and Company in its three-country study of SFPs.[30] The Checchi researchers noted the increasing likelihood of "incorrect paths" where schooling is nearly universal. Perhaps the situation in the United States--even in its relatively poorest communities--is not sufficiently precarious for SFPs to influence attendance, enrollment, or dropout behaviors.

2.6 Conclusions

Do SFPs make a difference with respect to school attendance and enrollment? The most appropriate answer seems to be that they probably do when there is a good fit between the SFP design and the environment in which the program operates. In many cases, however, judging from the literature, the fit may not be present or the evidence to support it is inconclusive.

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[29] Cited in Nelson et al. and Pollitt et al.

[30] Checchi and Company, Final Report: Evaluation Methods of Child Feeding Projects in Developing Countries, Chapter IV, "An Analysis of Pilot Study Survey Data in Three Countries" (Washington, D.C.: Checchi and Company, March 1977).

Perhaps the most interesting conclusion one can draw from the 22 studies discussed in this review is that, in general, the most rigorously designed studies are also, as a group, the least conclusive. The impact of SFPs on attendance and enrollment stems from a complex set of assumptions and relationships among many variables that are neither linear nor clearcut in many cases. It is, therefore, not surprising that a consistent pattern does not emerge from an analysis of the research done in this area. There is a need for a conceptual model that can explain these relationships for a variety of environments. If nothing else, the major finding one reaches when looking at the body of literature as a whole is that SFP impact is a function of program ecology. Yet, we do not have crisp guidelines to aid us in formulating policy for a variety of ecological settings.

Several of the attendance studies seem to support the view that SFPs work best in poor, stable, rural areas. They seem to be less effective when the poverty is abject and the need for child labor is great. However, alternative designs that stress the income-transfer potential in SFPs might alter this pattern.

Our picture of how SFPs operate on different segments of the population is incomplete. Are older or younger students more likely to remain in school because of an SFP? How does impact for boys differ from girls? If we had a better picture of differential impact, it would be possible to alter program designs accordingly. For example, if the enrollment ratio of girls is significantly lower than for boys, and if program planners were particularly interested in closing this gap (perhaps because of their awareness of how a mother's education influences fertility and the health and education prospects of future generations), it might be advisable to consider alternative means for targeting programs to girls. This might include a larger ration for girls, different eligibility requirements for boys and girls, and different messages to parents about the program and its benefits. This example illustrates why additional research is needed about how environmental factors influence program impact. If such a body of knowledge existed, program designers could put together the right package of features to achieve desired outcomes. The findings we currently have at our disposal do lead to a few design recommendations. These include the following:

-- In very marginal communities, SFPs must be designed as both an income-transfer scheme and as a nutrition supplement for enrollment and attendance benefits to occur.

- In general, it appears that those SFPs with the greatest impact on nutritional status will also be most effective in improving attendance.
- Program regularity (or efficiency) is critical to the success of any effort to increase enrollment or attendance through an SFP.
- Parents must be made aware of the program and its benefits for the full potential impact on attendance and enrollment to be achieved.

With respect to methodology, both retrospective and comparative studies show great promise when contextual variables are accounted for in the research design. The sociological path analysis used by Cotten in Haiti and the Checchi team in Colombia, Kenya, and the Philippines is especially promising for the insights it can offer when applied longitudinally. In general, care must be taken when doing either kind of study to use multiple measures to gauge both program participation and impact. For comparative studies, the systematic biases introduced by targeting must also be accounted for in the research design. These biases sometimes operate to favor affluent schools, whereas in other cases the opposite is true. Finally, for both types of studies, more attention needs to be focused on how SFPs alter dropout rates and seasonal variations in attendance.

In the following section the impact of SFPs on academic performance and cognitive development is examined. Once again there is evidence to suggest that impact is most decidedly a function of both program characteristics and the environment in which the SFP operates.

3. A REVIEW OF THE LITERATURE ON COGNITIVE DEVELOPMENT AND SCHOOL ACHIEVEMENT

This section focuses on three categories of research that are useful in assessing the actual and potential impact of school feeding programs on the cognitive development and academic achievement of participating students.

The first type of study analyzes the relationship between diet and cognitive development. This body of research suggests that the level of a student's cognitive performance is, in part, a function of the adequacy of his or her diet. The importance of these studies is that they establish a theoretical and empirical framework for a major claim made by advocates of SFPs, namely that when such programs provide undernourished participants with an adequate diet, cognitive development outcomes can be reasonably anticipated. These outcomes would include improved test scores, decreased repetition of grades, and, to the extent that school desertion is in part a response to academic difficulty, decreased dropout and absenteeism rates. The level of an individual's educational attainment is closely associated with a raft of development concerns including worker productivity, family health/nutrition status, income, fertility rates, propensity to modernize, and risk-taking. Thus, the SFP that demonstrably promotes improvements in students' academic performance and cognitive development is, from a developmental standpoint, potentially quite significant.

The second category of studies reviewed in this section analyzes the relationship between SFP participation and cognitive development in developing countries. Whereas the purpose of the first group of studies is to test the linkage between food intake in general and cognitive development, the second set of analyses permits us to test this same linkage in the context of an SFP operating in a developing country.

The final group of studies to be examined analyzes the relationship between SFP participation and cognitive development in industrialized nations. In Section 2, it was argued that the ecology in which an SFP operates significantly influences the nature and extent of program outcomes. It is in keeping with this line of reasoning--which appears valid for outcomes related to school attendance and enrollment--that the distinction between developed and developing countries has been introduced.

3.1 Studies on the Relationship Between Diet and Cognitive Development

The National Academy of Sciences was asked by President Carter in 1979 to determine what the research community could do to alleviate world malnutrition. In response to this invitation, a study team was formed and research objectives were identified. Investigation of the relationship between food intake and function was given the highest priority because of the consensus achieved in support of the view that malnutrition affects human capacities and behaviors in ways inimical to societal development.

Subsequently, AID, in an effort to advance such a research program further, asked the Committee on International Nutrition Programs of the Food and Nutrition Board, National Research Council, to convene a workshop (held in July 1977) to identify the major functional areas to be investigated. Eventually, five were selected, including three that are relevant to the present study: work output, cognitive function, and social/behavioral function.

In 1978, the University of California, Berkeley, was awarded a planning grant by AID to establish a collaborative research program in these areas. In partial fulfillment of this contract, the University published a report in 1980 that summarizes the state of knowledge concerning how varying levels of food/energy intake affect the individual's ability to function in society.[31]

With respect to cognitive development and social functioning, the report noted that mild-to-moderate malnutrition acts synergistically with social-environmental factors to affect cognitive function. Experimentally, however, it is difficult to separate the specific contributions of each. Most of the reports relating to malnutrition with cognitive deficit come from animal research (particularly rat studies) and neurobiological evidence. Mildly malnourished primates do not demonstrate primary learning deficits, but they do show passivity, apathy, shortened attention span, and failure to acclimate themselves to repetitive stimuli. Studies on preschool and school-age children are consistent with these findings, further suggesting that malnutrition may be associated with deficient performance of tasks involving short-term memory and attention.

With respect to activity, the report notes that very little is known about the relationship between food intake and the ability to perform work. However, some evidence from studies undertaken in Guatemala suggests that increased caloric intake affects work output positively. There is no doubt that severe nutritional deficit restricts an individual's ability to work. Individuals with mild-to-moderate deficiencies, however, appear to perform at some "adapted" activity level. For example, one adaptation to caloric restriction appears to be an increase in resting or quiet activities.

A background paper on nutritional status and cognitive functioning by Riciutti and Brozek appears as an appendix to the Berkeley report. The authors consider cognitive function to include memory, learning problem solving, language acquisition and use, and abstract thinking. They note that because of the interaction between under nutrition and the adverse social and environmental circumstances in which it occurs, evidence of a direct causal relationship between mild-to-moderate undernutrition alone and impaired intellectual competence has not yet been established. Consequently, they argue, one of the major issues to which future research should be directed is the question of how mild-to-moderate malnutrition and sociocultural, economic, and other environmental influences combine in affecting mental development and cognitive capacity. One important aspect of this question is whether the consequences of mild-to-moderate malnutrition and of improved nutritional status due to supplementation vary as a function of an individual's social and physical environment. Recent research on severe malnutrition is cited by the authors to suggest that the effects of supplementation are greater in "unfavorable" environments than in "supportive" ones.

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[31] Doris Howes Colloway et al., *Collaborative Research Support Program on Intake and Function* (Berkeley, California: University of California, May 31, 1980).

Riciutti and Brozek point out that in research on undernourished children, cognitive assessments have tended to be global, composite measures that rely heavily on IQ measurement. They conclude, however, that such assessments are likely to add relatively little new information on the ways in which nutrition and cognitive function are related. They posit that measures of specific cognitive processes hold out greater promise for obtaining useful data. Among the processes singled out for special consideration are ability to mobilize and maintain attention memory (both the acquisition and retention phases); behaviors for exploring and information-seeking; reaction to stimuli; the child's acquisition of language; and the child's progression through "stages" in the structure of thought (i.e., along the lines of the Piagetian model).

There has also been little research to date on other processes underlying intellectual performance and their relationship to malnutrition. These processes include sensory ability (psychomotor function, speed of response, activity level, and motor coordination) and temperament (apathy versus striving, emotional stability, aggressiveness, impulse control, attitudes, and responses to stress). These processes all involve maturation and change. Therefore, serial measurements will likely provide more useful answers to how nutritional status and behavior interact than measurements obtained at a single point in time.

Three other appendixes to the Berkeley collaborative research report provide excellent literature reviews on malnutrition and the acquisition of competencies related to intellectual development and learning (Riciutti; Ratoosh; Barrett and Radke-Yarrow). Ricuitti, summarizing many of these studies, notes that it is generally well known that protein-caloric malnutrition may lead to substantial impairment of physical growth, including altered brain development, particularly if the nutritional deficits are early, severe, and long lasting. It also is the case that children who have experienced protein-caloric malnutrition tend to show reduced levels of intellectual development and school performance. However, the research of the past decade has shown that it is extremely difficult, if not impossible, to evaluate the independent effect of malnutrition as such on mental development, apart from the influence of various adverse social and environmental conditions typically associated with malnutrition and capable in their own right of having a substantial impact on children's intellectual development. There has thus been a tendency to move away from the assumption of a direct, causal relationship between early malnutrition, altered brain development, and impaired intellectual functioning or mental retardation. Rather, there is increasing acceptance of the view that malnutrition must be examined in the environmental context in which it occurs and treated as one of the contributing factors leading to suboptimal mental development. This is particularly true in the case of early, severe, and prolonged malnutrition. The effects of mild-to-moderate, chronic undernutrition on intellectual development, however, are less well understood.

Several recent studies reflect this growing concern for understanding how malnutrition and various aspects of the child's social environment may interact synergistically to influence psychological development. These investigations have sought particularly to obtain estimates of the dependent contribution of nutritional versus socioenvironmental factors on cognitive development. Most studies employing this analytic approach typically find that simple indices of nutritional status (e.g., height, weight, hemoglobin count) and of socioeconomic factors are positively correlated (r's in the .20s to .30s range), with correlations of about the same order of magnitude being found between each of these predictors and measures of intellectual competence. Regression analyses tend to show that both social factors and nutritional history make some independent contribution to intellectual competence, with the percentages of variance attributable to each source varying substantially from study to study.

In Richardson's 1976 study of 6- to 10-year-old Jamaican boys, for example, 29 percent of the variance was attributed to social factors versus 5 percent for severe early malnutrition. On the other hand, work by Christiansen et al. (1974) on Colombian children ranging in age from 6 to 30 months attributed 18 percent of the variance to social factors and 32 percent to nutritional status. Regardless of the precise contribution of each category of variable, it has become increasingly apparent, on the basis of both human and animal studies, that a developmentally facilitative social environment may substantially attenuate or even prevent the potentially unfavorable consequences of early, severe malnutrition. Work by Richardson, Lloyd-Still et al., and Levitsky is particularly relevant in this regard.[32] Winnick et al., for example, related the IQ's and school achievement scores of adopted Korean children in American homes to the degree of early nutrition as indexed by height and weight before age 2. They found that the children's new, enriched environments led to significantly improved cognitive development.

Research findings suggest that the interactions of malnourished children with their environments make them less likely to seek out, utilize, and respond to available opportunities for learning and social interactions. Although in the late sixties and early seventies it was assumed by many researchers that the brain changes produced by malnutrition led directly to an impairment of learning, which was often irreversible, more recent studies have led most investigators to abandon this position. Currently, the most widely accepted hypothesis is that malnutrition exerts its major influence on behavioral competencies through dysfunctional changes in attention, responsiveness, motivation, and emotionality, rather than through a more direct impairment of basic ability to learn. This situation implies hopeful prospects for reversibility or remediation (e.g., through an SFP with a cognitively oriented component attached to it), because it is possible to manipulate the child's environment--particularly the school segment--to make his or her interaction with it more intellectually facilitative.

Ratoosh, in his analysis of research related to nutrition and psychological development, goes one step further and argues that empirical evidence drawn from current research supports the view that improvement of a child's diet alone can lead only to small changes in cognitive and social development. Meaningful change in this area only occurs when dietary change is accompanied by enrichment of the child's psychological and social environment.[33] Richardson's work, for example, indicated that malnourished boys differed significantly from the comparison boys on a number of unmatched but relevant variables.[34] He concluded that emphasis needs to be shifted away from nutrition as a primary cause of impairment to a broader concern for the total ecology of child development.

Related findings were reported by DeLicardie and Cravioto in their 1974 study of the responsiveness of 22 5-year-olds who survived clinically severe malnutrition to the "cognitive demands" of an intelligence test.[35] Results indicated that survivors of malnutrition showed a lower proportion of work responses than controls matched for IQ and sex.

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[32] See Calloway, Collaborative Research Program, pp. 272-273.
[33] See Calloway, Collaborative Research Program, p. 301.
[34] See Calloway, Collaborative Research Program, p. 305.
[35] See Calloway, Collaborative Research Program, p. 306.

In a similar vein, Patel et al. (1974), reported on the effects of undernutrition as opposed to severe malnutrition in young children.[36] The authors concluded that nutritional status was only one environmental influence on intelligence. They found evidence to suggest that any nutritional intervention program must also consider factors other than nutrition that might serve to rehabilitate deficiencies initially caused by poor nutrition.

One of the most frequently cited studies in the malnutrition literature was carried out in Guatemala by Cravioto, DeLicardie, and Birch (1966). Children from a rural village were rank ordered by height. The upper and lower quartile groups were then compared on a number of cross-model sensory tasks. The rationale for comparing the upper and lower quartiles was that the upper quartile children were assumed to represent the group with the least likelihood of having been at earlier nutritional risk. The authors found that the subjects in the lower quartile for height showed poorer intersensory integration for the visual, tactile and kinesthetic modalities than children in the highest quartile. Results were interpreted as supportive of the hypothesis that malnutrition results in a lag in the development of sensory integrative capacities. This lag, presumably, could be addressed in an educational intervention.

Four studies have attempted to establish functional relationships between malnutrition and child behavior using experimental intervention strategies. Primarily, they have involved an analysis of the effects of a food intervention program on the cognitive or social development of chronically malnourished children or children at risk for undernutrition. Each will be discussed in turn.

The INCAP Guatemala study (Klein, Yarbrough, Laskey, and Habicht, 1974; Klein, Habicht, and Yarbrough, 1970; and Habicht, Yarbrough, and Klein, 1974) was a 7-year longitudinal effort concerned with the effects of protein-calorie deprivation on children's physical and mental development.[37] The study's experimental design provided for the feeding of a protein-calorie supplement to children in two villages and a nonprotein, low calorie supplement to children in two neighboring villages. Over 600 children were included in the two feeding programs and participated in one or more tests of cognitive abilities at ages 5 or 7.

The investigators found generally positive and significant correlations between each of the cognitive measures (short-term auditory memory, memory for designs, reasoning, and vocabulary) and the two indices of nutritional status used, height and head circumference at ages 5 and 7. A second set of analyses, however, showed that differences in food intake (as opposed to nutritional status measures) over the 2-year period from age 5 to 7 could not be used to predict changes in psychological test performance on any cognitive measure between the ages of 5 and 7. It did not matter whether differences in food intake were defined in terms of home nutrition, food supplements ingested, membership in experimental feeding groups, or attendance at supplementation centers. In other words, given information about a child's test performance at age 5, one could not predict differences in improvement on that test over the next 2 years on the basis of information about protein-calorie intake over the 2-year period. This may well be a function of the inadequacy of the intervention design, providing, as it did, dietary supplementation but no specific, cognitively oriented treatment program.

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[36] See Calloway, Collaborative Research Program, p. 306.
[37] See Calloway, Collaborative Research Program, pp. 312-313.

The significance of the Guatemala study, however, lies in the experimental evidence it provides of the rehabilitating effects of nutritional supplementation on the sensorimotor and cognitive functioning of young children from an "at risk" population. The findings suggest a functional relation between chronic undernutrition and intellectual deficit. Further analyses examining relations between supplement intake and psychological test performance at higher age levels are needed to shed further light on the role of nutritional status in cognitive development.

The Cali Preschool Study is an important effort to examine the effects of a combined program of nutritional supplementation, cognitive stimulation, and health care on the cognitive development of lower class preschool children in Cali, Colombia.[38] The researchers used tests of immediate memory, verbal reasoning, color recognition, and object recognition as criterion variables in the study.

The investigation involved 240 3-year-old subjects who were assigned to either a nutrition plus stimulation plus health care condition or to a nutrition plus health care only treatment.

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[38] H.E. McKay, H. McKay, and L. Sinisterra, "Behavioral Intervention Studies with Malnourished Children: A Review of Experiences," in David J. Kallen (ed.), Nutrition, Development and Social Behavior. Proceedings of the Conference on the Assessment of Tests of Behavior, from Studies of Nutrition in the Western Hemisphere, Department of Health, Education and Welfare, publication No. (NIH) 73-242 (Washington, D.C.: U.S. Government Printing Office, 1973).

Within each of these 2 general groupings, subjects received either 1, 2, or 3 years of continuous intervention. The study included a control group of children of low socioeconomic status who received no intervention and a comparison group of upper income Colombian children, whose test performance was comparable to that of children from a low socioeconomic status at any point in the study.

This elaborate design provides a basis for inferences not only about the effects of nutritional rehabilitation on children's cognitive development, but also about the importance of social and cognitive stimulation with respect to behavioral change. It also allows for an examination of differential treatment effects related to duration of intervention.

Results obtained at the end of the study's second year showed that subjects experiencing 2 years of the comprehensive intervention improved in verbal reasoning and general knowledge, whereas children in the nutrition plus health care only groups did not show comparable improvements. Furthermore, the performance of the nutrition plus health care only groups on the cognitive measures was not substantially different from that of low socioeconomic status subjects in the control group. In no group, however, did subjects show significant improvement in tests of immediate memory.

The Tozonteopan, Mexico study was designed to assess the effect of a feeding program on mother-child interactions and child behaviors in the home.[39] Subjects were under 2 years of age. The investigators concluded, on the basis of parental reports, that the experimental children tended to be more demanding than children in the control group, both for attention and for food. In fact, the demands for food resulted in higher levels of feeding in the home for the supplemented subjects. Results of the study also indicated that children supplemented with proteins and calories were more independent and active than those not supplemented and elicited greater stimulation from their environment. It may be that a primary effect of undernutrition is to cause the child to withdraw from active participation with his or her environment, with the result that changes in cognitive abilities and perhaps patterns of social interaction occur.

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[39] Adolpho Chavez, Celia Martinez, and Tamara Yaschine, "The Importance of Nutrition and Stimulation in Child Mental and Social Development," in Early Malnutrition and Mental Development, edited by J. Cravioto et al. (Uppsala, Sweden: Almquist I. Miksell, 1974), pp. 211-225.

The Bogota study by Mora et al. examined the impact of a nutritional program on developmental quotations of previously well-nourished and malnourished preschoolers.[40] Analyses provided for a determination of empirical relationships among several social, physical, health, and intellectual variables. In particular, they allow for an assessment of the impact of the experimental intervention on intelligence test scores.

The investigators found that malnourished children scored lower on every "social" variable than well-nourished children. But they also found that height and weight measures significantly predicted initial status on the Griffiths Mental Development Scale for both younger and older children, even with social and "current health" variables controlled. This analysis suggested the importance of nutrition, independent of other social and medical factors, with respect to cognitive development.

The next step in the analysis was to examine directly the effects of the nutritional intervention on changes in intellectual performance. Results of the analyses for changes in Griffiths test scores showed that there was a general tendency for scores of well-nourished children to decline over the 1-year period, regardless of experimental condition, and for scores of malnourished children to increase. Because initial scores of well-nourished children were significantly higher than the initial scores of malnourished children, these changes were interpreted as a "regression to the mean" effect. However, the increase on Griffiths scores for the malnourished children in the supplemented group was significantly greater than for children in the nonsupplemented group, a difference the investigators suggested might be attributable to the effects of the food supplementation program.

This study provides additional evidence for the effects of chronic malnutrition on intellectual development. It also demonstrates that a 1-year food supplementation program administered during the preschool years may significantly improve IQ performance.

The evidence received from the studies thus far strongly suggests that early nutritional deficiencies may significantly retard intellectual development. Although the precise nature of the abilities that may be impaired has not been thoroughly investigated, it appears that sensory-integrative capacities, short-term memory, and attention may be particularly harmed. Although the implications of chronic undernutrition are less clear, research suggests that cumulative nutritional deprivation, like severe malnutrition, may interfere with optimal cognitive functioning during later childhood. Furthermore, as reported by Richardson, children who experience early severe nutritional deprivation tend to be socially immature relative to their peers and have difficulty controlling their behaviors. Although the basis for these difficulties in adjustment has not been specifically investigated, some of the problems observed in the social-emotional sphere may be due to the same type of "performance" factors known to influence cognitive functioning: apathy, reduced curiosity, inability to attend to and use complex stimuli, and lack of persistence. Such impairments would most certainly influence a child's performance in school. Other research points to the need to treat the child's cognitive and nutritional deficiencies holistically. Finally, the studies suggest that such deficiencies are indeed amenable to treatment, particularly where dietary and intellectual enrichment occur together.

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[40] See Calloway, Colaborative Research Support, p.313.

Balderston, in a literature review cited earlier in this report, examined the few longitudinal studies undertaken in which the impacts of specific interventions were assessed (e.g., the Cali, Bogota, Guatemala, and Mexican studies cited earlier).[41] She derives two important sets of conclusions from this body of research. First, nutritional intervention alone may account for bigger and cognitively more advanced children. In this regard, it is important to note that findings by Weinberg et al. show that bigger children consistently do better in school, remain in school longer, and have higher test scores.[42] Second, the nutritional and educational intervention studies show that the longer the treatment period, the greater the effect of the treatment, and, the vounger the child, the greater the impact of the intervention.

Other research reported by Balderston (e.g., Barnes et al., 1968) lends support for the hypothesis that early protein-calorie deprivation creates lasting effects on behavior. Some of these can be altered through later enrichment of diet, these behaviors, however, may not altogether disappear. Citing findings by Rosenzweig and Bennett (1980), she notes that the nervous system appears to be relatively plastic. Change in its structure occurs if the environment provides certain kinds of stimuli.

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[41] Balderston et al., Malnourished Children.

[42] Warren Weinbert et al., "Intelligence, Reading Achievement, Physical Size, and Social Class," Journal of Pediatrics, 85, 4 (1974): 482-489.

These views are echoed by Gussow in another review of literature on nutritional deficiency and mental development.[43] She cites the work of Yatkin and McLaren (1970) in which the development quotients (DQs) of severely malnourished Arab children were compared. Ample food and medical care were provided for one group; in the other case, the same food and care plus a stimulating environment were offered. With recovery from acute malnutrition, both groups improved their IQ scores as measured by the Griffiths Mental Development Scale. However, the stimulated group improved significantly more than the unstimulated group over the 4-month period, although "normal" levels of functioning were not attained.

In examining the implications of this work along with the research of McKay et al. in Colombia and Richardson in Jamacia, Gussow concludes that the evidence, although still tentative, suggests the importance of providing malnourished children with stimulation for both mind and body. This combination may enable them to make up for infancies spent in environments that were inadequate in both respects.

Gussow also reviews the research on the relationship between hunger and mental development, arguing that hunger is not malnutrition. The severely malnourished child often is not hungry, whereas the very hungry child may or may not be malnourished in ways that are measurable. She cites Riciutti's comment: "The school child who frequently misses breakfast or lunch may perform poorly because of inattentiveness and distractability associated with hunger. However, these potential influences on school performance and learning, about which we know very little, clearly need to be differentiated from those which are the result of long-term protein-calorie malnutrition."[44]

Where subclinical levels of malnutrition are involved, Gussow notes, the hard scientific evidence to support the notion that children's present biological condition correlates with their learning is best described as fragile. However, she reports that the few studies available have all tended to show that children who were better nourished did better. One study, for example, linked blood levels of vitamin C to IQ while two others evaluated the effect of iron-deficiency anemia on various measures of functioning.[45] Nevertheless, there have been no controlled studies to show whether the child who is very hungry is unable to work as well as one who is not hungry, or whether he or she is just unwilling to do so.

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[43] Joan Gussow, "Bodies, Brains, and Poverty: Poor Children and the Schools," Educational Resources Information Center (ERIC), IRCD V1, 3 (1969?): 3-4, 9-14.

[44] Gussow, "Bodies, Brains, and Poverty," p. 31.

[45] Gussow, "Bodies, Brains, and Poverty," p. 12.

Gussow, in a separate article, argues that given the probability that hunger interferes with learning, it would be preferable for schools to offer breakfast rather than lunch programs when only one meal can be provided.[46] She notes that most learning in schools takes place before lunch and it makes little sense, therefore, for children to sit through this period hungry.

Wilson also addresses the issue of hunger and its impact on school work in his review of the literature on interrelationships among diet, physical growth, verbal development, and school performance.[47] He too notes that the effects of current diet on school performance are not well documented. Several studies find, although a few fail to do so, that even in relatively well-nourished populations in the United States, temporary hunger (as opposed to malnutrition) may adversely affect attention, interest, and learning.[48] Wilson reports that such findings are consistent with Latham and Cobo's suggestion that low energy leading to inactivity has short-term effects on learning that can be cumulative, regardless of long-term nutritional status.[49]

The most significant aspect of Wilson's work, however, is his own analysis of the longitudinal data drawn from the INCAP and RAND studies in Guatemala on diet and school performance. He reports that a child's total diet was the largest and most significant factor affecting a teacher's assessment of performance, when prior verbal attainment, size, and a large number of other variables are held constant. Wilson concludes that this clear finding provides strong support for Latham and Cobo's thesis that current levels of energy have an important impact on learning and performance, even among children with comparable prior nutritional status and comparable levels of ability. This is consistent with work by Chavez, Martinez, and Yaschine (1974) that suggests that healthier children are more exploratory, active, and expressive and, therefore, elicit a more favorable and responsive social environment, as well as avail themselves better of existing learning opportunities.[50]

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[46] Joan Gussow, "Nutrition and Mental Development, "Education Resources Information Center (ERIC). IRCO Urban Disadvantaged Series, 36 (1974).

[47] Cited in Balderston et al., Malnourished Children.

[48] Rand 1973, 1975 as cited in Balderston et al., Malnourished Children; and Pollitt et al., "Educational Benefits."

[49] Michael C. Latham and Francisco Cobo, "The Effects of Malnutrition on Intellectual Development and Learning," American Journal of Public Health, 61 (July 1971):1307-1324.

[50] Chavez et al., "The Importance of Nutrition and Stimulation."

Two other studies lend additional support for the relationship between diet and school performance. In their research on Filipino children, Popkin and Lim-Ybanez discovered a significant positive association between weight for height (a measure of current nutritional status) and the child's ability to concentrate in school.[51] They also noted that children with higher hemoglobin levels were less likely to be absent from school.

Moock and Leslie's study of childhood malnutrition and schooling in the Terai region of Nepal provides additional evidence for the view that efforts to improve child nutritional status may have educational as well as health and survival benefits.[52] Of those children in their sample enrolled in school, taller children tended to be in higher grades than shorter children of the same age. Given the high rates of academic failure and repetition, grade attainment can be treated as a proxy for academic achievement. Moock and Leslie report that Jamison has reached the same conclusion for Beijing as well as the Gansu and Jiangsu provinces of China.[53]

What is the relevance of this literature to SFPs and their potential for facilitating cognitive development? The following observations seek to address that question.

1. Cognitive function may be defined as the ability to learn categories, to process and structure information, and to learn and react to social and environmental cues. It includes the ability to ask appropriate questions and provide appropriate answers within a given environment and to identify and solve relevant problems. It embraces general conceptual ability, appropriate actions within a given culture, and the mental adaptiveness needed to entertain new categories and see new possibilities. Mild-to-moderate malnutrition, although probably not causing primary learning deficits, does appear to alter processes associated with cognitive function. Passivity, apathy, shortened attention span, reduced short-term memory, failure to acclimate to repetitive stimuli, and a lag in the development of sensory-integrative capacity are all associated with mild-to-moderate malnutrition. These dysfunctions prevent children from taking maximum advantage of the learning opportunities available to them in their environments. Not surprisingly, children with protein-caloric malnutrition tend to function at reduced levels of intellectual development and academic achievement. Children

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[51] Barry Popkin and Marisol Lim-Ybanez, "Nutrition and School Achievement," Social Sciences and Medicine, 1981.

[52] Moock and Leslie, Childhood Malnutrition.

[53] Moock and Leslie, Childhood Malnutrition.

appear to adapt to malnutrition by seeking out more quiet and restful activities. The contribution of SFPs to cognitive development must be assessed in this context.

2. Given the complexity of cognitive function and the range of learning-related impairments associated with malnutrition, research on supplementation and cognitive development must rely on more complex measures of cognition than IQ. Instrumentation that can capture changes in school-age children related to ability to mobilize and maintain attention, development of sensory-integrative capacity, reaction to stimuli, and behaviors related to exploring and seeking information is especially needed. Because many of these processes are a function of maturation, there is a need for serial measurement that can capture the rate of change in subjects.

3. Mild-to-moderate malnutrition acts synergistically with social and environmental factors. The risks for a malnourished child, living in a culture of poverty, are multiple, interactive, and cumulative. However, both human and animal studies show that a developmentally facilitative environment can alleviate the potentially harmful consequences of early malnutrition. Reversibility and remediation are possible when the child's environment is manipulated to make it more conducive to his or her cognitive growth. Although improvement in a child's diet alone can lead to cognitive changes, greater intellectual development can be achieved when the child's diet as well as his or her psychological and social environment are enriched. These findings suggest that SFPs can only reach their full potential for stimulating cognitive development when they are designed as part of a broader intervention to address developmental lags or deficiencies in students.

4. A school-age child's nutritional status exerts significant influence on academic performance. In Wilson's study, for example, current diet was the single most significant predictor of classroom achievement. Likewise, hunger seems to cause inattentiveness and distractability and thus is likely to influence school performance and learning. Hunger, of course, is not the same as malnutrition. SFPs that are successful either in reducing a child's feelings of hunger or improving his or her nutritional status are likely to facilitate cognitive development as it has been broadly defined in this section (i.e., mobilization and maintenance of attention; development of sensory-integrative capacity; and exploratory, problem-solving behaviors; memory). These changes may not be well captured on IQ tests.

In the section that follows we shall turn our attention to an examination of four studies on the impact on cognitive development of SFPs in developing countries. The observations and conclusions drawn from the review presented thus far will be instrumental in evaluating the methodological soundness of the research designs.

3.2 Studies on the Relationship Between SFP Participation and Cognitive Development in Developing Countries

Roy and Rath, in their evaluation of the school lunch program in Orissa, India, compared the academic performance of boys participating in SFPs with those not participating.[54] Using examination scores, they found no significant differences between the two groups. Earlier in this report (Section 2.2), the methodology employed by the researchers with respect to sampling and analytic procedures was described and critiqued. This section, therefore, will be confined to an assessment of the findings specifically related to achievement and cognitive development.

The authors note that student performance in examinations and the proportion of failures are indicative of a school's academic standards. Therefore, they analyzed the distribution of student scores on the examination administered nearest to the time of the study. Virtually no difference was observed in the distributions of scores achieved by SFP-participating and nonparticipating boys. The former obtained a median score of 38.1, whereas the latter's median was 38.9. The failure rate for both groups was also nearly equal (approximately 28 percent) when data were taken both for entire schools and for individual grades (with the exception of grade three, where a statistically significant difference was observed in favor of the non-SFP schools).

These findings, however, are difficult to interpret for several reasons. First, the authors failed to report whether the examination was standardized or teacher-made. If it was teacher-made, the results are not surprising given most teachers' tendency to use the students in their own classes as reference groups for grades rather than objective criteria. This practice usually leads to fairly constant distributions of students' marks, so that a normal curve is maintained even when groups differ quite notably from one another. Thus, the proportion of individuals on the "honor roll" in a school in which students are cognitively advanced is not dramatically different from that of a school in which many pupils suffer cognitive deficits. Children tend to be judged in relation to one another, particularly in situations where the teachers are not pedagogically sophisticated.

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[54] Roy and Rath, School Lunch in Orissa.

Even if the examinations are standardized, the scores alone cannot be used to judge the efficacy of the SFP intervention vis-a-vis school achievement. The SFP schools (as noted in Section 2.2 of this report) had more tribal students and a smaller number of upper caste children than non-SFP schools. Because socioeconomic status exerts a significant influence on school achievement and because the student bodies in the SFP schools were of a lower socioeconomic status than these from non-SFP schools, it would be expected that without the intervention, students from non-SFP schools would score higher on standardized tests. Therefore, it can be argued that the SFP was successful by raising the level of academic achievement obtained by the lower socioeconomic status students participating in the SFP to that obtained by the more advantaged, nonparticipating children. The lack of a statistical difference in scores, thus, may be one measure of the program's success in providing equality of educational opportunity for children, regardless of their social or economic background. This discussion underscores the need for researchers to control for socioeconomic status when comparing academic achievement or cognitive development for SFP-participating and nonparticipating students.

Kanno's study of how an SFP affected the learning of primary school children in Lesotho was based on a sample of 155 children, ages 6 to 11, from 27 villages.[55] The study was conducted for 1 year and involved visits to 115 households and the administration of a questionnaire to determine the adequacy of home meals as related to the school feeding program.

To test the effects of the SFP on learning among primary school children in Lesotho, the investigator used an intelligence test, anthropometric measurements, close observations in classrooms, and teachers' reports. No significant differences were noted on intellectual measurements or on anthropometric increments between SFP-participating and nonparticipating children. Although both school and home meal patterns were deficient for the children, school feedings provided the only source of protein in the children's diets.

This study, as does the previous case, fails to present an analysis of data that controls satisfactorily for socioeconomic status. Thus, once again, the finding of "no difference" may, in fact, be attributable to the success of the SFP in "bridging the gap" between more and less advantaged pupils. When targeting takes place, SFP schools will have larger numbers of children in need than those not served by an SFP. On the other hand, the research methodology does have a significant strength: the use of multiple measures that can serve as proxies for intellectual development.

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[55] Nellie B. Kanno, "Effect of School Feeding Schemes Upon Learning Among Primary School Children in Lesotho," Ph.D. dissertation, Michigan State University, 1973.

Two studies discussed in the previous section--Cotten's work in Haiti and Checchi Company's comparative evaluation of SFPs in Colombia, Kenya, and the Philippines--also include an assessment of SFP impact on cognitive development. Because Cotten was significantly influenced by the Checchi team's work, the same methodological critique applies to both studies. Therefore, findings from the two studies will be reported separately but interpreted together.

With regard to SFP influence on cognitive performance, Cotten's data indicate that program children scored higher than nonprogram children on the Raven Coloured Progressive Matrices Scale, an IQ test, but the difference was not statistically significant. In noting the very positive relationship between the Raven score and a set of indicators that measured the student's home environment, Cotten surmises that the preponderant cause of marginal differences in performance between program and nonprogram children could be due to differences in home environment (with program children tending, on the average, to come from higher socioeconomic status environments) rather than differences in nutritional status.

Support for this argument is found through the analysis of another variable, tuition. A positive correlation was found between what a child's family had to pay for schooling and the child's cognitive performance as measured by the Raven score. Tuition was viewed by Cotten as a surrogate indicator of the socioeconomic status of the child's family. The implied linkage was thus interpreted by the investigator as follows: a wealthier family can afford higher tuition; higher tuition implies better education, which in turn results in a child who performs better in school. The results of a "t" test on the tuition variable indicated that tuition in nonprogram schools was higher than in program schools because of inclusion of private schools in the sample. Cotten concludes that this finding supports the argument that exogenous factors--which the SFP does not attempt to influence--provide just as plausible an explanation for differences in performance as does participation in the SFP. He believes that the longitudinal study that is planned to supplement this assessment will be helpful in shedding greater light on this issue.

Cotten also found that about 7 percent of the variance among schools in average Raven test scores could be explained by variance in the prevalence of acute malnutrition. With the addition of home environment, 19 percent of the variance in cognitive performance was accounted for, while inclusion of the tuition variable improved the association another percentage point. All three variables thus combined to account for 20 percent of the variance in aggregate performance on the Raven test. This finding once again suggests the need to design intervention strategies that address both nutritional status and environmental factors that influence intellectual development.

The importance of the interaction between the school environment and a child's nutritional status is also illustrated by another study finding. Cotten constructed a "quality of education" index that measured variables known to influence learning such as lighting, classroom density, teacher/student ratio, teacher education and experience, and the proportion of students passing the Primary School Certificate Exam. In the rural milieu, as is the case in virtually all developing countries, the "quality of education" indices were significantly lower than indices for urban areas. In this environment, there was a significant difference between mean Raven scores obtained by children who were well nourished as compared with children who exhibited wasting. In urban areas, on the other hand, where the availability of external influences on a child's mental performance is greater, there was no significant difference in cognitive performance between the well-nourished children and those showing signs of wasting. This discrepancy points to the need for intellectual and nutritional stimulation for children living in environments that are not developmentally facilitative for SFPs to meet their cognition-related objective.

Cotten also investigated the relationship between hunger (as opposed to malnutrition) and intellectual performance. Citing research by Keys, he hypothesized a relationship between hunger ("a psychological and physiological state resulting from insufficient food intake to meet immediate energy needs") and a classroom behavioral pattern characterized by irritability, apathy, and similar dysfunctions. Individual children in the sample survey who came to school without breakfast were identified and their performance on the Raven test was compared with average performance for the school.

It was observed that within the SFP-schools, there was a highly significant difference between the peformance levels of the two groups. Children who came to school without breakfast did markedly worse than their less hungry counterparts. On the nonprogram side, however, there was no significant difference between the two groups. No explanation of this finding for nonprogram schools is offered. Perhaps the inclusion of more private schools (with their attendant higher quality of education) in the nonprogram sample is the cause. If so, this, too, would suggest that quality of the learning environment and diet interact in the determination of a child's intellectual ability. When the environment is developmentally rich, the intellectual stimulation available can compensate for some of the effects of hunger and, quite possibly, malnutrition. This finding also highlights the need to research whether school breakfasts should be offered instead of or in addition to lunches.

In short, Cotten's work demonstrates the importance of accounting for background factors, particularly socioeconomic status, and the need to hold these variables constant over time for the researcher to isolate program effects on cognitive development. His evaluation design, using as it did cross-sectional data, did not show how children changed over the time they participated in the program. The forthcoming longitudinal study will treat this issue. Specifically, it will be able to address whether cognitive development occurs at a faster rate for SFP-participating children when socioeconomic status-related variables are held constant.

The Checchi study examined SFP impact on school performance as measured by teacher grades controlled for the child's IQ (derived from the Raven Progressive Matrices). The sample consisted of children from first and third grades. In all, five school programs in each of three countries (Colombia, Kenya, and the Philippines) were examined. Net direct effect of participation in the program was assessed; such background characteristics as family income, mother's education, and the tested scholastic aptitude of children were taken into account. All associations that had a beta weight less than +.10 were treated as if they were zero.

Comparisons were made between SFP-participating versus nonparticipating children, as well as between children with more versus less exposure to the feeding program within the participating group. The authors note that most of the large, negative results for participating versus nonparticipating students could be traced to comparisons with advantaged control groups. Hence, the more versus less exposure criterion appears to be the more valid one.

The research team determined that it was necessary to obtain a measure of intelligence for school children and to control teacher-assigned grades by child's IQ. This procedure was decided on as a way of holding constant any difference in school performance abilities related to past influence (such as a child's parents or upbringing).

The Raven Coloured Progressive Matrices Scale was used to obtain this measure of intellectual ability. The authors described it as widely used in developing countries and especially appropriate for cross-cultural research as it is relatively culture-free. The test was administered without time limits. When time limits are imposed, it becomes more heavily loaded with scholastic performance factors.

The instrument itself is a perceptual test of spatial and pattern relationships in which the student matches one of six tabs with a pattern on it against a larger pattern with a missing tabular piece. When untimed, it is designed to assess a subject's present capacity for intellectual activity, irrespective of previously acquired knowledge. As a whole, the scale is described as a test of observation and clear thinking.

The effect of school feeding on performance was inconclusive and apparently unrelated to the ability of programs to reach other goals (e.g., improved attendance and nutritional status). It had been posited by the research team that performance could be affected by food in at least two ways: through the effect of nutrition on mental growth and development or through the effect of nutrition on energy levels. The former claim could not be substantiated through a study of this type because the subjects were all school-age children past the period of rapid brain growth. However, the second claim was investigated by the research team, which noted that nearly all the first and third grade teachers interviewed reported that children participating in SFPs performed better after eating. These subjective but uniform judgments were somewhat offset by the mixed pattern of effects that emerged from the more objective survey data.

A significant relationship between increased feeding and good grades was found in 6 of the 15 schools. In the other schools, there appeared to be few performance effects that could be attributed to SFPs. At first glance, this may seem to be a relatively negative finding with respect to the efficacy of SFPs as a tool for improving student intellectual development. On the other hand, Jencks et al. in their landmark study of the determination of school achievement note that the effects of IQ and family background are so powerful that relatively few interventions designed to improve student performance can override them.[56] When judged in this context, a program that yields gains for disadvantaged students in six locales may appear to be a cup two-fifths full rather than three-fifths empty.

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[56] Christopher Jencks, Inequality: A Reassessment of the Effect of Family and Schooling in America (New York: Harper and Row, 1972).

The research team notes that further thinking about indicators of performance is warranted. They suggest a measure of matriculation (staying in school) as one alternative to school grades that control for the child's IQ. They argue that this is especially so in the context of SFPs in poor countries where the basic educational need is literacy. To measure this, it would be necessary to follow up recipients to study how many stay in school from one grade to the next. A record of persistence in staying in the educational system would constitute "good performance" for these children. In most developing countries, where emphasis is placed on providing the bulk of the school-age population with basic education, a measurement of matriculation would capture the degree to which SFPs assist in promoting this goal.

An analysis of the Cotten and Checchi studies must focus fundamentally on two principal issues: (1) how can cognitive development or school performance be best measured and (2) by what standard should a program be judged as either sucessful or unsuccessful? A search through the psychometric literature (see the list at the end of the Bibliography) uncovered not a single study that tested the hypothesis that the Raven scale was truly culture-free when administered to children. One researcher, Abul-Hubb, used it with populations above age 14 in Iraq. For ages 14 to 17, the Iraqi subjects attaining a raw score of 40 were at the median. The test manual gives a raw score of 44 for the 50th percentile.

It seems highly likely that cultural factors might account for group differences with respect to tolerence for abstraction. Other reviewers note that the test measures IQ in terms of a single intellectual function, visual perception. Because hunger and malnutrition are believed to influence a range of intellectual functions, this instrument may not be sensitive to the kind of cognitive development that could be promoted by a successful SFP.

Most reviewers and the test author claim that the instrument measures "innate" intellectual ability. If this is the case, it is questionable whether such a scale would be sufficiently sensitive to changes in intellectual functioning derived from an educational or school-based program. Some reviewers have also noted that the test's reliability is not very high when administered to young subjects. Furthermore, validity is threatened in those developing countries in which reliable age data are difficult to obtain.

Given this situation, the test is probably useful in controlling for teacher-assigned grades or as part of a student background assessment (although its cross-cultural validity is somewhat suspect) but not adequate by itself as a proxy for intellectual development. Indeed, the test's author recommended that it be used in concert with vocabulary scales for an assessment of current intellectual functioning.

Earlier in this section, it was suggested that procedures that capture changes in children's ability to mobilize and maintain attention, develop sensory-integrative capacity, react to stimuli, and engage in information-seeking and problem-solving behaviors would be especially useful in assessing the impact of SFPs on intellectual functioning. Cognitive development is a dynamic process that is best assessed through maturational scales rather than through relatively static, unidimensional IQ tests.

In conjunction with such scales, simple measures of school success should be used. The Checchi team's recommendation that a matriculation measure be employed is very direct and appropriate to the nature of the inquiry. Of course, it will be necessary to control for socioeconomic status. What we want to learn is whether children participating in SFPs stay in school longer and develop intellectual capacities at a rate that exceeds that of nonparticipating students, all else being equal.

The second question that needs to be addressed is the standard for judging an SFP "successful" in overcoming cognitive dysfunctions related to acute malnutrition. When targeting practices result in an SFP population with an average socioeconomic status below that of non-SFP students, a successful program may be one in which the gap between the two groups has been narrowed rather than closed. A very successful program, following this line of reasoning, would be one in which no difference between the two groups is observed, whereas at the highest success level, the SFP-participating group would surpass the nonparticipating population. This discussion highlights the need for baseline data and more prospective research. Once again, the principal focus for investigation must be how groups compare to each other with respect to rate of change when socioeconomic status is controlled.

When inadvertant targeting occurs and the SFP-participating population is of a higher socioeconomic status than the nonparticipating group (as in the programs examined in Haiti and Orissa), success will, of course, be defined differently. However, once again, the key to program assessment will be how the two groups (participating versus nonparticipating) compare with respect to rate of change. Quality of education and socioeconomic status must be factored into the analysis.

In conclusion, the following additional observations are offered for the efficacy of SFPs in promoting cognitive development:

1. The evidence for the proposition that SFPs can enhance cognitive development is inconclusive. More research is needed in which longitudinal data are collected and multiple measures of school achievement are used. Comparisons between SFP and non-SFP schools on measures of achievement are only relevant when they can be interpreted in light of socioeconomic status differences between the two populations.

2. Likewise, comparisons between SFP and non-SFP schools should be augmented by an analysis of differences between students with more versus less exposure to the program in the participating group.

3. Factors exogenous to SFPs exert as much influence on school performance as do feeding programs. Nevertheless, none of the SFPs discussed here incorporates into its design any feature that might mitigate the impact of these "intervening" factors. The SFP intervention strategy needs to be recast as a more integrated effort to remediate deficits caused by the interaction among acute malnutrition, hunger, and a developmentally nonfacilitative home environment.

4. Cotten noted that 7 percent of the variance in Raven scores could be explained by malnutrition. Although this proportion may appear at first glance to be small or insignificant, a gain in intellectual competence of this magnitude (the equivalent of raising a child's IQ from 95 to 100) would actually have a far-reaching impact on the quantity and quality of classroom learning. This finding, therefore, underscores the need for SFPs to offer meals that are nutritionally adequate to overcome chronic malnutrition.

5. Cotten's research suggests that in schools in which the quality of education is low, it may be especially important to alleviate hunger for learning to take place. Research on the efficacy of breakfast versus lunch programs is needed in developing countries.

In the following section, we examine the impact of program context on the promotion of cognitive development. Is there a difference between developing countries and industrialized nations in the evidence linking SFPs to school performance?

3.3 Studies on the Relationship Between SFP Participation and Cognitive Development in Industrialized Nations

Most reviewers[57] have divided this literature, which, except as noted, deals with the United States, into two basic categories: (1) studies dealing with short-term behaviors (with an emphasis on morning feedings and the effects of hunger) and (2) studies on long-term effects (with an emphasis on school performance). In this section, six studies pertaining to the first category and five relevant to the second will be reviewed.

The existence of two major categories reflects the presence of two general approaches that have been used to investigate the effects of SFPs on non-nutritional aspects of student behavior. Studies of short-term effects have yielded conflicting results. Investigations of the long-term effects of SFPs on school achievement and attendance have failed to demonstrate conclusively significant relationships. It is important to note, however, that these programs were not expressly targeted to malnourished students. Thus, the question of whether SFPs could have a beneficial effect on the academic achievement of malnourished children is left unanswered.

As Pollitt has noted, research on the behavioral effects of SFPs is, in most instances, methodologically weak. It is marked by ambiguity in the definition of variables, a lack of data on the validity and reliability of the measures used, and an absence of specific hypotheses. Therefore, a great deal of caution must be exercised in interpreting findings.

3.3.1 Studies on Short-Term Behavioral Effects

These studies have investigated the effects of eating or not eating breakfast and of eating a mid-morning snack. The behaviors targeted for research included nervousness (Laird et al., 1931 and Keister, 1950); hyperactivity, withdrawal, and hostile behavior (Keister, 1950); aspects of mental performance, including arithmetic and decoding tasks (Matheson, 1970); and short-term attention (Dwyer et al., 1954; Arvedson et al., 1969).[58] Each study will be briefly reviewed before turning to their collective implications. (See Table 1 for a comparative summary of studies on short-term behavioral effects.)

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[57] See, for example, Nelson et al., National Evaluation; and Pollitt et al., "Educational Benefits."

[58] These studies are all cited in Nelson et al., National Evaluation; and Pollitt et al., "Educational Benefits."

Table 1. Summary of Studies of Short-Term Behavioral Effects of Morning Feedings

Study	Treatment	Sample	Measures	Analysis	Results
Laird et al., 1931	Children received milk, milk plus calcium supplement, or no special feeding at 9:30 a.m.	Children from grades 1, 3, and 5 who were rated as "nervous" N = 48	Behavior checklist to access nervousness	Comparisons of pre- and post-treatment ratings of nervousness. No statistical tests.	Nervousness of groups receiving milk was reduced an average of 6%
Keister, 1950	Children were fed pineapple juice or water at 10:00 a.m.	Nursery school children N = 133	Observation of hyperactivity, withdrawal, hostile behavior, and nervous habits for 2 hours after feeding	Comparisons of frequency of observed hyperactivity, withdrawal, hostile behavior, and nervous habits after receiving juice or water	Children receiving juice exhibited fewer negative behaviors than children receiving water
Tuttle et al., 1954	Subjects alternated between eating breakfasts and not eating breakfasts; total daily intake was kept constant	12- to 14-year-old boys from one school N = 7	Neuromuscular tremor magnitude, choice reaction time, grip strength, work rate, work output, attitudes, and scholastic performance	Comparison of individual and group mean scores on measures taken when eating and not eating breakfast	Maximum work rate and work output lower when breakfast was not eaten
Arvedson et al., 1969	One group received breakfasts that provided 400 calories and one group received breakfasts that provided 560 calories; the protein and carbohydrate composition of both groups' breakfasts were alternated weekly	11- to 17-year-old boys from one school N = 40	Blood glucose, work tests, concentration, hunger, tiredness	Comparison of measures among groups eating various types of breakfast	No differences were found except that blood glucose levels were higher when a protein-rich rather than a carbohydrate-rich breakfast was eaten
Matheson, 1970	Each student received orange juice or nothing alternately at 10:30 a.m. for 10 days	Fifth-graders from three schools N = 100	Performance on math and decoding tests at 9:15, 10:30, and 11:45 in the morning; 3-day record of breakfast intake	Comparisons of performance when orange juice was given and when it was not Comparison of performance at different times according to usual breakfast intake of children	Performance was better on days orange juice was given Performance of children with good and poor diets did not differ at various test times
Dwyer et al., 1973	One group received liquid meal in morning; one group received liquid meal in afternoon	First-grade boys N = 139	Attention tasks; dietary recall of breakfast intake	Comparison of morning performance on attention tasks	Performance did not differ between those children fed the liquid meal in the morning and those fed in the afternoon

Source: Kathryn Nelson et al., The National Evaluation of School Nutrition Programs, vols. I and II (Santa Monica, California: Systems Development Corporation, April 1981), p. 493.

Laird et al. (1931) examined the relationship between hunger and nervousness in children. The sample consisted of 48 first, second, and third graders who had been rated as nervous by their teachers on the basis of a behavior checklist. The children were assigned to one of three groups: a control group that received no special feeding; those who received milk only; and those who were given milk and a calcium supplement. The children were fed for a 2-week period at 9:30 a.m., after which their behavior was reassessed, presumably by their teachers, who supposedly did not know the treatment groups to which the children had been assigned. For the group fed milk, it was reported that their nervousness had declined by an average of 6 percent. However, half the group showed either no decline or an increase in nervousness at the end of 2 weeks. Laird and colleagues concluded that the nervousness of elementary school students is associated with hunger and can, therefore, be alleviated through mid-morning milk programs.

This study is methodologically weak for several reasons. There is no discussion of how the observation procedures were validated and the high level of subjective judgment required to complete the checklist (e.g., "mentally lethargic") argues against the probability that the instrument could be used with any degree of reliability. Furthermore, the data were not subjected to statistical tests.

Keister (1950) studied the effects of a mid-morning fruit juice program on hyperactivity, withdrawal behavior, hostility, and nervousness on 133 children from 2 to 5 years of age attending a nursery school. The investigation lasted a year. Each child's behaviors were observed at 30-second intervals for 2 hours following the feeding. Keister found that the juice drinkers exhibited significantly fewer negative behaviors than those who received water. Despite an absence of any significant age differences, males who received juice showed a greater reduction in negative behaviors than females who were given juice.

As does the work by Laird et al., Keister's study suffers from an apparent lack of reliability and validity. Data were obtained through a checklist designed by the investigator. However, no information on the instrument's validity and reliability is reported. Although experimental and control conditions were imposed, there is no evidence to suggest that the observers were unaware of the treatment received by each child.

Tuttle et al. tested the effects of different breakfast conditions on physical performance in children.[59] Boys aged

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[59] W.W. Tuttle et al., "Effect on School Boys of Omitting Breakfast," Journal of American Dietetics Association 30 (1954): 674.

12 to 14 alternated between periods of basic cereal and milk breakfasts and no breakfast for 17 weeks. The total daily nutrient intake, however, was kept constant. Six categories of physiologic responses were tested in the late morning hours. Omission of breakfast had no effect on neuromuscular tremor magnitude, choice reaction time, maximum grip strength, or grip strength endurance. However, maximum work rate and maximum work output were less when breakfast was omitted. The students' attitudes and scholastic performances were rated by their teachers and were reported to be better for the majority of the boys when breakfast was eaten.

Vermeersch et al. in their review of this study note that the portion of the research that measured breakfast/no breakfast effects on student attitudes was not as well controlled as the portion dealing with the effects on physical performance.[60] No systematic behavioral checklist was used by the teachers rendering judgments. Furthermore, the teacher-observers were aware of whether the boys had received breakfast on the days they offered their assessments.

Arvedson et al. (1969) sought to test the assumption, prevalent in the 1950s, that breakfast should provide one quarter of the total daily protein and caloric intake to ensure maximum physical and mental efficiency in the late morning hours. For this purpose, a sample of 203 children aged 7 to 17 was drawn from several Stockholm schools.

They found that of these children, only one-third consumed a breakfast at the "ideal" level. Their next step was to determine if this low intake had any effects on physical capacity. The investigators then studied 40 boys, ages 11 to 17. They were divided into four groups, each receiving a different type of breakfast (high carbohydrate, 400 calories; high carbohydrate, 560 calories; high protein, 400 calories; high protein, 560 calories). The subjects were given a work test involving a bicycle ergometer. No differences in physical capacity were found for the various types of breakfasts. Concentration, hunger, and tiredness were measured on the days that work tests were not administered. The authors also found no significant difference in the physical and mental performances or in the reports of hunger and tiredness among the groups eating the various breakfast types.

The study does not, of course, address the effects of breakfast omission on school performance. Rather, it suggests that breakfast type (rather than presence or absence) is of little importance in determining work output. Breakfast type also appears to be insignificant in terms of influence exerted on such learning dysfunctions as inability to concentrate and fatigue.

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[60] Cited in Nelson et al., National Evaluation.

Matheson (1970) measured the effects of mid-morning orange juice feeding on 100 fifth grade students from three classrooms at three different schools. The study was conducted over a 10-day period. The outcome variable studied was an addition and letter symbol decoding test. The same children were exposed to both the experimental and control conditions. The mid-morning orange juice feeding was associated with a significantly better performance at 9:15, 10:30, and 11:45 a.m. on tasks of decoding and addition. Testing following the orange juice feeding at 10:30 showed the most significant improvement on the decoding tasks. The researcher also found that the performance of the tasks at different times during the morning did not differ significantly between children whose usual breakfast intake was good or poor; however, breakfast intake was not measured for the day of the testing but was obtained through a 3-day written record collected several weeks after the experiment was conducted. Matheson concluded that students score higher on school-type tasks undertaken shortly after they receive food.

This study lasted only 10 days, an interval that Vermeersch and colleagues suggest may not have been long enough to bring about adjustments in children whose breakfast habits were longstanding.[61] Pollitt suggests that this investigation offers the strongest methodological treatment of short-term effects of feeding. Therefore, in his view, it provides important support for the contention that food supplementation in school early in the day brings about some beneficial effects on a child's performance in school-type tests.

Dwyer et al. (1954) measured the effects of an instant breakfast on children's school performance. The study subjects were 139 first-grade boys, half of whom received the liquid meal in the morning, while the other half received it in the afternoon. The researchers, comparing morning performance on several attention tasks, found no differences between the two groups.

Pollitt, in trying to account for the different conclusions obtained by Dwyer and Matheson, suggests that this might be attributable to differences in breakfast intake between the populations used in the two studies. Furthermore, the two studies may have been tapping different mental abilities. The attention measures used by Dwyer were tests of slow tapping, digit recall, and building with toy blocks, as well as observations of eye gaze to assess maintenance of attention in the classroom. Matheson, on the other hand, tested for addition and letter decoding.

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[61] Cited in Pollitt et al., "Educational Benefits."

It is difficult to draw conclusions about the implications of these studies for SFPs in developing countries. First of all, the children in these studies were not necessarily malnourished. Second, the studies used different types of measurements, so they are not comparable to each other. In some cases, the mid-morning feedings may have been supplements to breakfast, whereas in others they may have been substitutes. Furthermore, only Matheson and Dwyer were directly concerned with cognitive dimensions of behavior. The other studies--dealing as they do with emotional dimensions of behavior and physical activity--have important although less direct impact on the degree to which a child can take full advantage of the opportunities present in his or her learning environment. Finally, four of the studies (Dwyer et al., 1973; Keister, 1950; Laird et al., 1931; Matheson, 1970) suffered from a lack of systematic controls on the observations made to categorize behavior and from a failure to assess adequately food intake of children prior to their arrival at school. The other two experiments (Arvedson et al., 1969; Tuttle et al., 1954), as Vermeersch notes, were more adequately controlled, but there is no way to ensure that some of the results were not affected by the subjects' knowledge of the treatment they received. As Pollitt states in his review, these methodological weaknesses are the strongest evidence for a need for additional research in this area. However, he also notes, in light of the evidence, that the provision of breakfast may benefit students emotionally and enhance their capacity to work on school-type tasks.

3.3.2 Studies on Long-Term Behavioral Effects

Five studies have looked at long-term, cognitively related behavioral effects of SFPs (Lininger, 1933; Tisdall et al., 1951; Pinkus, 1970; Kreitzman, 1973; and Lieberman et al., 1976). Unlike the short-term studies, these investigations exhibit more uniformity. Most used a longitudinal approach, and the most common outcome measures were closely linked to school performance. Major differences among the studies include the treatments investigated, the samples' characteristics, the programs that were analyzed, and the specific tests and modes of analysis used. (See Table 2 for a comparative summary of studies on long-term behaviorial effects.)

Table 2. Summary of Studies of Long-Term Behavioral Effects of School Nutrition Programs

Study	Program(s)[a]	Treatment	Sample	Measures	Analysis	Results
Lininger, et al.,	SMP[b]	Students did or did not get milk	"Under-nourished" students ages 6-16 N = 4,133	Teachers' ratings of scholastic progress, reports of milk consumption	Percent of children receiving milk who improved compared with percent of children not receiving milk who improved	Improved scholarship found for 45% of students using milk and for 24% of those not using milk.
Tisdall et al., 1951	NSLP[b]	Lunch program implemented and students selected to participate by modified randomization	Participants aged 5 1/2 to 10 1/2 and matched nonparticipants from three Canadian schools N = 200+	School grades, intelligence, reading, and arithmetic test scores	Comparison of scores between participants and nonparticipants; no statistical analysis presented	Grades and intelligence, reading and math scores of participants and nonparticipants did not differ
Fellers, 1967	SBP[b]	Not clear from report	10th-grade participants and nonparticipants in one school N = 198	School grades, dropout rate	Comparison of final grades and dropout rate between participants and nonparticipants at end of school year	Final grades and drop-out rates of participants and nonparticipants did not differ
Pinkus, 1970	SBP	Student did or did not participate in breakfast program	Grade 4 from 8 Louisiana schools participating and not participating in SBP N = approximately 200	Pupil breakfast habits; pupil recall of crying, anger, and misbehavior; parent and teacher records of pupil crying, anger, and misbehavior; absenteeism; school grades for 1 month	Comparison of results between pupils in participating and non-participating schools	Proportionally more no-program students went without breakfast than program students did. More no-program students than program students reported crying, being angry or misbehaving frequently; however, this difference was not reflected in teachers' and parents' records. Absenteeism and scholastic achievement of program and no-program children did not differ
Koonce, 1972	SBP + NSLP vs. NSLP only	Students participated in school lunch or school lunch plus breakfast or neither program	Grades 1-3; students receiving free lunch and breakfast, free lunch only, or no school meals N = 60	Attendance; teacher ratings of students' disposition, responsiveness, and classroom participation	Comparison of teachers' ratings between NSLP-only and NSLP + SBP participants; comparison of absence rates among the two participation groups and nonparticipation groups	Teacher ratings were higher for NSLP + SBP children than for NSLP-only children. Absenteeism did not differ among groups.
Kreitzman, 1973	SBP[b]	Breakfast program implementation at treatment school but not at control school	Grades 3-5, one program and one no-program school in Atlanta, GA. N not reported	Attendance, grades, scores on achieve-tests	Comparison in spring of measures between program and no-program students; no statistical tests applied	Achievement scores did not differ between program and no-program third graders, but tended to be higher for program fifth graders than no-program fifth graders
Lieberman et al., 1976	SBP	Breakfast program implemented at treatment school but not at control school	Grades 3-6; one program and one no-program school in low-income neighborhood in Compton, CA N = 551	Standardized tests for concentration, memory, abstract thinking performance	Comparison of fall and spring scores of students in program and no-program schools	Test scores of program and no-program students did not differ

[a] SMP = Special Mix Program
SBP = School Breakfast Program
NSLP = National School Lunch Program.

[b] May include programs not sponsored by the U.S. Department of Agriculture.

Source: Kathryn Nelson et al., The National Evaluation of School Nutrition Programs, Vols. I and II (Santa Monica, California: System Development Corporation, April 1981), p. 500. Report for the U.S. Department of Agriculture.

Lininger (1933) studied the effects of a school milk program on scholastic progress over a 2-year period among 4,133 "undernourished" (not defined) students aged 6 to 16 years.[62] The subjects were enrolled in special health classes in which the use of milk was emphasized as part of a broader strategy for improved health. An index of scholastic progress was obtained from teachers' subjective comments. Over the study period, 45 percent of the children receiving milk were shown to have improved "scholarship." Where milk was not used, improvement was noted in 24 percent of the cases. However, teachers probably knew which students were receiving milk. Therefore, it is difficult to say whether those results stem from the intervention or teacher expectations. This study also suffers from probable defects in reliability, given the nature of the checklist and lack of rigor in determining criteria for selection of malnourished students.

Kreitzman (1973) looked at attendance and school grades to determine the effects of a school breakfast program in a yearlong study.[63] The subjects were third and fifth graders from two schools in Atlanta, Georgia who were living in a government housing project. One school had no breakfast program; the other began one in January. At the end of the school year, there was no difference between the two groups in achievement test scores. It should be noted, however, that this finding may have been related to a supplementary educational program that was being offered for third graders in the control group. This ambiguity points to the need noted elsewhere in this report for a greater understanding of the potential interaction and interdependence between cognitive development interventions and SFPs. Where no such program was operating (in the fifth grade), those in the experimental group did as well or better on every segment of the achievement test than the control group.

Unfortunately, Kreitzman does not report any statistical treatment of the data collected. "Significant differences" were reported strictly on the basis of observation, rendering this study of limited usefulness to policymakers.

Tisdall et al. (1951), in the Canadian Red Cross School Meal Study, evaluated over 200 school lunch participants and control students who ranged in age from 5 1/2 to 10.[64] The investigation lasted 3 years. School performance measures included teacher-assigned school grades, scores on IQ tests, and scores on objective tests of reading and arithmetic. The experimental and control groups were matched for gender, school grade, classroom age, height, weight, socioeconomic status, dental condition, mental ability, school achievement, and health status as measured on a health exam.

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[62] Cited in Pollitt et al. "Educational Benefits."

[63] S.N. Kreitzman, "Evaluation of Craddock Breakfast Study" (Atlanta: School of Dentistry, Emory University, 1973, unpublished).

[64] Cited in Pollitt et al., "Educational Benefits."

The authors found no evidence to indicate that the SFP had any effect in accelerating mental or educational development. It is difficult to analyze this conclusion, however, because no statistical analysis was presented in the report. It is also unclear whether the degree of program exposure was controlled. Furthermore, the nutritional status of students is not disclosed.

Pinkus (1970) examined the breakfast habits, school performance, and hunger-related behaviors of two groups of fourth graders, those attending a school breakfast program and those in schools where the program was unavailable.[65] All children came from eight Louisiana schools that met Federal requirements for the program. The two groups were matched by predominant race of students, class size, and faculty size. Questionnaires were used to gather data on breakfast and behavior patterns for approximately 200 students.

More children in the non-SFP site reported a higher frequency of crying, being angry, and being asked to pay attention or stop misbehaving. However, no significant differences were observed between the two groups when the comparison was made on the basis of 1-week behavior records kept by parents and teachers. Furthermore, no significant differences were found on scholastic achievement as measured by the number of D's and F's durng a 1-month period. As noted earlier, many teachers grade on a curve. If this were the case in this study, it would be unreasonable to expect to see a change in the distribution pattern of grades. The relatively short duration of the grade comparison period may also have been insufficient to uncover any trends in this area.

Lieberman et al. (1976) studied the effects of a breakfast program among low-income black ghetto children in grades three through six over 1 school year.[66] A school with a breakfast program (n=300) was compared to an adjacent school (N=281) without a program. Five psychological tests were administered to measure ability to concentrate, remember, think abstractly, and work in a classroom. The authors found no long-term program effect associated with psychological test scores. However, children in both groups were well nourished. Furthermore, 52 percent of the children participated in the program between 35 to 54 percent of the time, although exposure was not controlled.

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[65] Cited in Pollitt et al., "Educational Benefits."
[66] Lieberman, "Ghetto School Breakfast Program."

Pollitt observes that this study is a good illustration of how the nature of the sample determines the nature of the investigator's results. Because the recipients of school breakfasts were well nourished before they entered the SFP, it is unlikely that their participation brought any additional nutritional benefit to them. Given that situation, it is not surprising that the SFP brought no additional educational benefit. Such a study fails to answer the crucial question of whether a program that starts with poorly nourished recipients and brings about nutritional status improvement will also yield educational benefits.

The apparently contradictory findings of these studies make it difficult to draw conclusions about them. Two investigators (Leininger and Kreitzman) found a beneficial program effect, whereas the others did not. The research set, as a whole, does suggest the need to understand and account for the many and often confounding intervening variables in feeding and achievement studies, as well as the need to control for program exposure. The differences in findings may also be due in part to differences in the designs and samples employed.

In summary, the findings with which we are left fail to provide a strong basis for any policy decisions regarding the relationship between SFP participation and cognitive development in malnourished children. Lack of methodological rigor and, in particular, designs that fail to account for moderating variables characterize these studies.

The investigations, however, do highlight the need for additional research into the relationship between SFPs and cognitive development. Some recommendations with respect to future work include the following:

-- Longitudinal research is needed. One year is probably not adequate to detect all cognitive development effects produced by SFP participation. Any shorter time period is clearly insufficient. A 2- to 3-year research project in this area would be most desirable.

-- Program effectiveness on malnourished children must be measured. Because impact varies with a program's ecology, it is important to avoid drawing inferences for malnourished children from data that were obtained on well-nourished subjects.

-- Kreitzman reported that third graders who participated in a supplementary education program but received no school breakfast did as well on achievement tests as students who received breakfast but did not have access to the remedial intervention. In the fifth grade, where no supplementary education was available, the breakfast program participants surpassed the control group on the performance measures. This finding highlights the need to design studies that one compare and assess the cognitive impact of SFP interventions with and without additional intellectual development components incorporated into the treatment package.

In the following section, the general implications of the research on nutrition, SFP, and cognitive development are discussed. Special attention is given to the concerns of policymakers.

3.4. Conclusions

Without question, the cognitive abilities of a nation's citizenry are of utmost importance to planners. Worker productivity is so intimately linked to problem-solving skills and more generalized cognitive development that it is difficult to imagine how any high-level decision-maker could fail to be concerned with removing impediments to the optimal intellectual functioning of young people. However, despite the need, the present collection of studies offers relatively little guidance to the policymaker who must choose among alternative social investments.

The studies are inadequate to planners for a variety of reasons, including lack of methodological rigor (particularly with respect to the work done in industrialized countries) and comparability of findings. Consequently, the definitive answer to the question of whether SFPs make a significant difference in the cognitive development of students is unknown. However, preliminary indications are that they do.

Two studies in particular, both methodologically sound in all respects, provide the basis for this assertion: Wilson's work in Guatemala and Moock and Leslie's research in Nepal. In the former study, the child's total diet was the largest and cost significant factor affecting a teacher's assessment of performance, when all other relevant variables were controlled. This finding lends support to the thesis that current energy levels have an important impact on learning and performance even among children with comparable nutritional status and levels of ability. In Moock and Leslie's work, taller children tended to be in higher grades than shorter children of the same age. This led the authors to suggest that efforts to improve children's nutritional status may have educational as well as health and survival benefits for the children involved.

Unfortunately, policymakers cannot simply accept that children's nutritional status influences their school achievement --particularly when the children are malnourished or hungry--and derive a course of action from this assertion. The research findings are fairly uniform with respect to an important point: mild-to-moderate malnutrition acts synergistically with social-environmental factors to affect cognitive function. Therefore, policymakers must decide the extent to which malnutrition can be dealt with in the environmental context in which it occurs. If policymakers treat malnutrition as one of the factors leading to suboptimal mental development (as the literature suggests), what other factors should they address and what will the coverage and cost implications of this decision be? From the cost standpoint, it might prove more expedient, politically and otherwise, to reach nearly everyone in the "at risk" school-age population with a partial intervention than to reach only a smaller beneficiary population with a more nearly perfect treatment strategy. If the choice is made to opt for a food-only intervention, the planner can bolster this decision with the assertion (Latham and Cobos) that low energy levels lead to inactivity, which in turn produces short-term effects on learning that can be cumulative regardless of long-term nutritional status. If, on the other hand, the policymaker selects an intervention program that also addresses factors other than nutrition in order to rehabilitate deficiencies initially caused by poor nutrition, fewer children may be reached (because of cost considerations), even though the intervention is sounder.

Other conundrums also face the planner. How nutritionally adequate must the feeding intervention be for cognitive outcomes to occur? Arvedson's study suggested that the type of breakfast was not important (although the subjects were Swedes, who presumably were not malnourished), and Checchi's three-country study found that the effect of an SFP on performance was unrelated to the program's ability to reach nutritional status goals. On the other hand, Cotten found that 7 percent of the variance on an IQ test--not an insignificant proportion--could be explained by the presence or absence of malnutrition. Once again, the answer appears to vary according to the program's ecology. Where acute malnutrition is endemic, nutritional adequacy is probably more important than when hunger, but not malnutrition, produces learning dysfunctions. If hunger is a major impediment to learning, school breakfasts may be the most appropriate intervention. However, the planner must determine the criteria for selecting breakfast versus lunch or snack programs. Selection of one type of program over another should be based on a careful assessment of need as well as past practice and custom.

Finally, planners need to look at who precisely is benefiting from SFPs. Aggregate data may obscure important results. If, for example, the program is particularly successful in overcoming the cognitive deficits of girls or socioeconomic groups that are at the margin of their country's development, the resultant closing of the equity gap may well justify investment in the program.

All of these issues have implications for the design of SFPs. In the next section, recommendations are presented for how SFPs can be designed to yield the maximum benefit for attendance, enrollment, and cognitive development.

4. DESIGN IMPLICATIONS

4.1 Introduction

The purpose of this section is to identify approaches that can maximize the educational impact of AID-supported school feeding programs. Generally, SFPs are designed to meet three objectives: (1) to improve the nutritional status of school-age children; (2) to increase school attendance through the provision of a snack or meal; and (3) to improve children's ability to benefit from instruction by removing hunger or nutritional deficiencies as obstacles to learning. These objectives suggest that SFPs are intended to support or strengthen the typical array of host country strategies designed to improve the internal and external efficiencies of school systems. Nevertheless, there have been few if any attempts in the literature to state explicitly how SFPs can contribute to school system efficiency. The following is an initial effort to fill this void.

Internal efficiency generally refers to the relationship between a school system's curricular expectations for students and what actually happens to students within the system. Typical indicators used to gauge a system's internal efficiency include the proportion of students in a given grade who are "over age," enrollment ratios, absenteeism, wastage rates, repetition rates, subject area or examination failure rates, and the proportion of students in a cohort of school entrants who successfully complete a given level of schooling in the prescribed number of years. In other words, these measures focus on whether student learning takes place at the prescribed pace. Education sector strategies that are designed to improve school attendance, expand school enrollments, and facilitate greater mastery of curriculum objectives (either by improving teacher quality or providing improved instructional materials) are all geared toward the goal of enhancing internal efficiency.

External efficiency is used to connote the relationships between what schools teach (or try to teach) and what a country needs to meet its development goals. For example, the curriculum for rural primary school students in a given developing country might emphasize the values and lifestyle of the urban elite. This may encourage many who leave primary school to emigrate from the countryside. At the same time, however, the country's development plans might stress rural microenterprise development. The education system is subtly undermining the government's ability to achieve this goal; an external inefficiency of far-reaching consequences is operating. Typically, education sector reforms designed to address external efficiency questions feature attempts to make curricula more relevant. This may be accomplished by introducing vocationally oriented studies, by regionalizing curricula, by stressing lifelong learning skills, and by creating a milieu in which students have ample opportunity to apply to home and community what they learn at school.

From the foregoing, it can be seen that SFPs could, if properly designed, improve both internal and external efficiencies. Yet seldom are programs planned to take full advantage of this potential. In Sections 4.2 and 4.3, specific design issues are raised and suggestions presented that will help planners begin to focus more concretely on how SFPs can have a greater educational impact.

4.2 SFPs and Enhanced Internal Efficiency

At the outset a critical assumption concerning SFPs must be made explicit: food alone, although necessary, is insufficient to overcome cognitive deficits in school-age children who have a prior history of significant nutritional deprivation. Food can, however, be an important weapon in the arsenal of approaches. Let us see how.

The key to using SFPs as a means for supporting the school's cognitive development efforts is in using the feeding activity as a springboard for cognitively oriented interventions. The meal or snack period, for example, can become the occasion for structured verbal interaction between students and adults. Vocabulary, language fluency, and syntax can all be improved by encouraging children to talk about shared interests or topics of importance in a nonthreatening setting. Likewise, children can be helped to acquire the competence needed to prepare all or part of the meal. This would involve mastery of such critical skills as following directions, measuring, translating written symbols into actions, planning future actions, and evaluating performance for the purpose of improving it. Social skills would also be developed by enabling children to work together in the preparation and serving of food.

Needless to say, unless teachers are trained to use the SFP as a means for promoting cognitive development, it is unlikely that such outcomes will occur. Many attempts to improve teacher quality fail because the training program is not able to provide the support needed for teachers to "unlearn" deeply ingrained behaviors. A 2-week workshop, for example, designed to help teachers use fewer rote techniques in class and to rely more heavily on student-centered active learning principles depends in part for its success on the trainer's ability to undo the teachers' years of practice with rote methods (first as a student, later as a teacher). This is the equivalent of breaking a long-standing habit. In contrast, the task of helping teachers acquire new behaviors related to school feeding programs is much easier, because their belief systems concerning such programs are not nearly as deeply etched as many other beliefs related to classroom instruction. Thus, SFPs can serve as an entry point for providing teachers with pedagogically sound training that is likely to be applied in the classroom (or cafeteria) setting.

Changing teacher behaviors is a nearly impossible task if those who supervise them do not support the proposed changes. This means that any teacher training effort must be paralleled by work with school inspectors and headmasters. At this level, training should focus on identifying a broad range of interventions that can be carried out to overcome whatever cognitive deficits exist in the student population. SFPs should be viewed in this broader context.

Most strategies for improving the internal efficiency of schools focus to some extent on improving teacher quality. Training around the SFP is one means for accomplishing this end, if feeding and cognitive development can be purposefully and deliberately linked. At the same time, however, care must be taken that SFPs do not significantly decrease the time teachers have available for classroom instruction. Otherwise, internal efficiency gains made through training may be more than offset by lost instructional time. When this occurs, we can say that the opportunity costs of participating in SFPs become too high. Strategies to reduce or minimize the opportunity costs of SFPs include parental or student involvement in food preparation, teacher participation in the design of SFPs, use of easy-to-prepare foods and recipes, and the careful scheduling of food preparation time so that it does not compete with instructional demands.

In most developing countries it is not possible to provide all schools with SFPs. Thus, targeting recipient schools becomes a critical task. Frequently, targeting is based on the assumed or assessed nutritional status of school-age children. In some cases, the targeting is done at the level of individual schools or geographic zones; occasionally, the program is targeted to specific children within the school setting. In looking at how the educational impact of SFPs can be improved --specifically at how SFPs can increase a system's internal efficiency--several implications for targeting practices suggest themselves. First, targeting to individual schools or geographic areas is preferable to targeting on specific children. Aside from the fact that targeting within schools tends to promote ration dilution, the practice also dilutes such education payoffs as teacher participation or interest in SFP-related training, integration of feeding with cognitively oriented activities, and widespread parental involvement or contact with the school through its feeding program. If SFPs are to become a springboard for far-reaching educational improvements, they cannot reach only a portion of the students enrolled where they operate.

In addition to deliberate targeting, inadvertent targeting may also operate in the selection of SFPs. This occurs when the requirements of site selection tend, unwittingly perhaps, to favor certain categories of schools over others. For example, if the selection criteria call for the presence of a storage area, a minimally equipped kitchen and some community capacity to supplement or transport the food, it is easy to see how less wealthy communities frequently fail to meet these standards. The result, of course, is that those communities most in need of the food from both the nutritional and cognitive development vantage points may be less likely to receive it than communities where the need is not as great. Program designers and managers may wish to develop strategies for identifying communities in which children are both cognitively and nutritionally most at risk. In those cases where the community is unable to meet site selection criteria, special assistance or dispensations should be considered.

Most frequently, SFPs are conducted as either school lunch or snack programs. In only a relatively small number of cases have breakfast programs been implemented. Yet one of the most commonly cited justifications for SFPs is that they increase student's attentiveness and, therefore, academic performance (the critical dimension of internal efficiency). If this line of reasoning is valid--and several studies suggest that it is, although others lend themselves to contradictory interpretation --then it may well make most sense to schedule the meal or snack immediately prior to the time when the most cognitively demanding part of the curriculum is taught. In most cases this will mean at the beginning rather than in the middle of the school day. Afternoons are more often used for art, physical education, and vocationally oriented studies. The advantages of placing an SFP early in the day may be offset by the disadvantages associated with a child's returning home at noon: the need to expend calories to walk long distances, an inadequate lunch that fails to compensate for this caloric expenditure, and the increased probability of absenteeism in the afternoon. On the other hand, early morning feeding programs probably do not produce the substitution effect that lunch programs do, because in many developing countries families do not serve breakfast to children. The correct decision concerning the timing of the SFP depends on many factors. However, if all other things are equal and the school schedule is more demanding in the morning, school breakfasts or early morning snacks may have a greater impact than other kinds of SFP intervention.

It was noted above that enrollment ratios and absentee rates are two frequently used measures of a system's internal efficiency. SFPs are often defended on the grounds that they serve to draw students to enroll in school and encourage them to attend once enrolled. Once again the evidence for the claim is mixed, and the methodologies employed in gaining the evidence are not of uniformly even quality. However, it seems that the degree to which SFPs attract students is a function of many variables. Two of the most important are:

1. The opportunity costs of school attendance compared to the market value of the food

2. The probable return on a student's investment in education compared to the revised opportunity cost of schooling (where revised opportunity costs equal fees, books, uniforms, and foregone wages minus the market value of the food)

Where the opportunity costs are high and the market value of the food is low, families are better off keeping their school-age children at home unless it is likely that school enrollment will contribute to an enlarged stream of earnings in the future. Even in countries where fees, books, and uniforms are minimal, the opportunity cost of schooling may be high if the child's labor can be gainfully used (or if it enables someone else to seek gainful employment, as in the case of a child who takes care of younger siblings so that the mother can work outside the home). The implication of this analysis is that ration size may be a powerful determinant of an SFP's ability to attract students in those countries where opportunity costs of schooling are high and the probable return on investing in just a few years of primary school is low. Full breakfasts or lunches will be inducements to enroll, whereas snacks probably will not draw more students. Conversely, in cultures where education has a clear economic benefit and where opportunity costs of schooling do not serve as a widespread barrier to enrollment, SFPs are likely to have little impact on attendance and enrollment. In these cases, snack programs may be a more cost effective intervention than full meal programs for meeting nutritional and cognitive needs.

In summary, then, SFPs can contribute to the increased internal efficiency of school systems if they are properly planned. Such planning must begin with the recognition that food alone cannot completely overcome cognitive deficits present in nutritionally deprived school-age children. However, SFPs can serve as the springboard for a variety of activities designed to improve teacher quality and the cognitive functioning of students. Decisions about the timing of feeding (early morning or mid-day), ration size, and target population should also be governed by the level of educational impact that is deemed desirable. Let us now turn to a discussion of how SFPs can influence external efficiency.

4.3 SFPs and Enhanced External Efficiency

Any discussion about improving a school system's external efficiency is rooted in the belief that education exerts a powerful influence on the attainment of a country's development objectives. This influence can be either positive or negative. Where negative, the curriculum is largely irrelevant and the values it emphasizes inappropriate. Often this negative influence is exerted in such a subtle manner that teachers, parents, and students are unaware of it. These unintentional lessons that schools teach are called the "hidden curriculum." SFPs provide educators with many opportunities to shape the hidden curriculum in ways that support more broadly based development efforts.

A key aspect of SFPs is that they provide an avenue for all segments of the community to participate in school activities. Under the best of circumstances, parents will organize to supplement the commodities with locally raised produce or purchased foodstuffs. This creates the opportunity for dynamic synergisms between classroom nutrition education and community decision-making. Immediately, that portion of the curriculum is bestowed with a special relevance.

Local groups of parents often need to organize themselves in support of an SFP if the program is to succeed. Not only must they work to supplement donated commodities, but they also need to make decisions about program logistics, including meal preparation, product delivery, and maintenance of cooking facilities. The net result of this participation is twofold: parental involvement in a broader range of school matters is promoted and the local community development efforts are stimulated. The degree to which community involvement is deemed important to program planners may influence a number of management decisions. For example, on-site cooking probably offers more community development potential than programs using readyto-eat foods. Similarly, SFPs that serve all enrolled children probably stimulate more widespread parental involvement than programs targeting only some children for participation.

SFPs can be designed to encourage the production of local foods either by parents or children. Thus, they can become a departure point for teaching about soil preparation, prevention of soil erosion, seed germination, and other aspects of food cultivation. These principles can be applied in a school garden. All too often, however, school gardens prove unsuccessful. Many factors contribute to their failure: vacation breaks, thieving, and unsuitable land, for example. Decision-makers need to ask themselves what the educational message of a failed garden is? It may well be advisable to explore alternatives to the traditional school plot. One possibility is to have students grow food on nearby working farms in cooperation with landowners. Such an approach would probably promote a higher degree of transfer between school and home, while contributing to increased relevance of the curriculum to local conditions and needs.

If the SFP is structured so that imported commodities will be phased out over a specified period of time, the program may also contribute to the promotion of community self-reliance. This would certainly be an important lesson to include in the hidden curriculum. Self-reliance, however, will only be achieved if the community involvement has been carefully nurtured.

Decisions about the size and type of rations should also be examined from the perspective of the hidden curriculum. What behaviors are modeled for children when the SFP is based either on snacks or unbalanced meals? What is the implicit nutrition education message conveyed by the ration? It may well be that the SFP unwittingly contradicts the more carefully planned intent of the school's nutrition education curriculum.

Effective nutrition education can make an important contribution to a system's external efficiency, because what is learned by one generation has a significant bearing on the rearing of future generations and, therefore, on a country's stock of human capital, a critical ingredient in all development strategies. SFPs provide a valuable opportunity to make nutrition education efforts meaningful. They can become the basis for exploring best nutrient buys, proper handling and storage of foods, food preservation and preparation, and alternative sources of important nutrients. For classroom nutrition education to reach its potential, targeting messages to local priorities is essential, as is the use of sound pedagogy.

In summary, SFPs can be designed to improve external efficiency by reinforcing more broadly based development objectives. Programs that encourage community participation, supplementation and eventual phaseout of donated commodities, local production of foodstuffs, and consistency between SFP and nutrition education messages will have the greatest educational impact.

4.4 Conclusions

In examining the literature on SFPs, it appears that the potential impact of SFPs may not have been reached. This is in part because they were designed exclusively or primarily from the standpoint of nutritional rather than educational needs. Effective program planning must be based on a careful examination of both sets of needs and how they relate to each other. In some situations, educational needs might be given a higher planning priority; in others, the reverse will be true.

In evaluating SFPs, greater clarity is needed concerning the relative priorities given to each objective. Where internal efficiency questions are of paramount interest, simple proxies for cognitive development are needed. Perhaps the rate of successful student completion of a given grade might prove useful if such critical intervening variables as teacher quality, distance between home and school, prior education of the mother and family, and socioeconomic status can be controlled.

Research is also needed to compare the relative impact of lunch and breakfast programs on school performance. Either a longitudinal approach within the same school setting or a comparison of matched communities might prove to be a useful framework. Once again, a pass/fail rate might be suitable in gauging cognitive development if intervening variables can be controlled. Any comparison between breakfast and lunch programs should also measure differential effects on school attendance.

In addition, further research is needed to assess the impact of alternative distribution modes. For example, would a snack and lunch be a more potent combination in terms of nutritional status, attendance, and school performance than a breakfast and snack program? To what extent can commodity levels be reduced without diluting an SFP's educational (as opposed to nutritional) benefits? These are all questions that require serious analysis and discussion.

The methodological difficulties of conducting good research in this area are numerous. The relationships between SFPs (the independent variable) and school attendance or performance (the dependent variables) are seriously confounded by a series of intervening variables that collectively may exert more influence on the hypothesized relationship than the independent variables alone. Adding to the difficulties of inferring relationships is the need to take into account seasonal variations that might influence school attendance and attentiveness.

For planners, however, the most pressing concern should be the identification of whatever other inputs are needed in combination with SFPs to promote educational change. Children do not live by bread alone, and while food is undoubtedly a necessary condition for healthy growth and development, it certainly is not sufficient. Only when SFPs are viewed as but one component of broader schemes to improve education will they be able to achieve their full potential as vehicles for improving the internal and external efficiency of school systems in developing countries.

Section 5 presents a framework for an operations research project that could provide answers to these questions. Specifically, the proposed analytical framework would assist planners in matching the ecology of a program setting to design features so that the right mix of inputs could be made available at every program site.

5. CONCLUSIONS AND NEXT STEPS

Do school feeding programs increase attendance, improve academic performance, and contribute to higher enrollment ratios? The studies that have been undertaken thus far fail to provide us with a conclusive answer to this question. They also neglect, by and large, to relate impact to beneficiary population characteristics to enable planners to determine for which individuals SFPs are most likely to make a difference. Clearly, what is needed is further research. Of equal clarity, however, is the need for a new approach to the problem of assessing program benefits.

In this section, the broad outline of an operations research project on the impact of SFPs is sketched. It is intended not as a complete, self-contained methodological guide to inquiry in this area (which it most definitely is not), but to highlight the kinds of issues that must be systematically addressed in order for policymakers to answer three basic and interrelated questions: (1) What kinds of changes do SFPs promote and for whom? (2) To what extent are these changes interdependent? (3) Given a particular set of ecological conditions, what is the ideal SFP design to promote improvements in enrollment, attendance, and academic achievement?

The justification for an operations research approach lies in five major weaknesses within the body of research on SFPs that is presently available. First, not a single study involved the use of baseline data collected prior to the advent of the SFP. Thus, it is virtually impossible to assess the degree to which the program prompted changes in the beneficiary population. Specifically, the lack of prior measures for attendance rates, enrollment ratios, and academic achievement means there is no strong basis for making inferences concerning the impact of the intervention on these variables. Second, in only a few studies were such intervening variables as socioeconomic status and quality of the educational environment adequately controlled. Thus, it is difficult to determine the extent to which differences are attributable to the intervention itself or to dissimilarities in the sample populations. In many of the comparative studies, particularly, the control and experimental groups were not really comparable. Third, data are generally reported in aggregated terms making it impossible to measure impact on groups of students generally deemed to be most vulnerable to nutrition-related problem: girls, rural children from landless families, ethnic minorities, children from incomplete families, and children from the most economically marginal households. Fourth, with the exception of Cotten's work in Haiti, the studies are not longitudinal and therefore tell us nothing about how SFPs influence rate of change in the variables of interest, attendance, enrollment, and academic performance. Finally, none of the programs evaluated to date appears to be "state of the art." Thus, we cannot learn what the optimal impact of an SFP might be under very favorable and highly replicable conditions. In the case of a program that seeks to induce cognitively oriented changes in students, "state of the art" at the very least probably means that the intervention design must incorporate a component concretely related to the desired cognitive outcomes.

These limitations impede the search for definitive answers to the three basic questions noted earlier. Let us look at each of these issues in turn and break them into a series of interrelated, probing hypotheses that would form the agenda of an operations research project in this area. The first question asks about the kinds of changes SFPs promote and the characteristics of students most affected by these changes. The probing hypotheses associated with this issue include the following:

1. Do SFPs lead to positive changes in school enrollment ratios? What are the characteristics of those students for whom SFPs do and do not constitute an inducement to enroll? Are SFPs effective in promoting enrollment among students deemed to be most vulnerable to nutrition-related problems?

2. Do SFPs lead to improvements in school attendance among enrolled students? What are the characteristics of those students for whom SFPs do not constitute an

inducement to attend? Are SFPs effective in promoting attendance among students deemed to be most vulnerable to nutrition-related problems?

3. Do SFPs lead to reductions in the wastage rate as measured by the proportion of students in the first grade who complete primary school in the prescribed number of years? What are the characteristics of those students for whom SFPs do and do not constitute an inducement to complete primary school in the prescribed number of years? Are SFPs particularly effective in reducing the wastage rate among students deemed to be most vulnerable to nutrition-related problems?

4. Do SFPs contribute to a student's increased ability to engage in the cognitive processes closely associated with learning (e.g., ability to concentrate and attend to instruction, short- and long-term memory, intersensory integration)? What are the specific cognitive processes most amenable to change through a school feeding intervention? What are the characteristics of those students particularly benefited by SFPs in the area of cognitive development? Are SFPs particularly effective in promoting cognitive development among students deemed to be most vulnerable to nutrition-related problems?

5. Do SFPs contribute to improvements in student academic performance? What are the characteristics of those students whose academic performance appears to benefit from the presence of an SFP? Are SFPs effective in improving the academic performance of students deemed to be most vulnerable to nutrition-related problems?

6. Do SFPs contribute to improvements in student nutritional status? What are the characteristics of those students who derive greatest nutritional benefit from SFPs? Are SFPs effective in improving the nutritional status of students deemed to be most vulnerable nutritionally?

The second broad issue concerns the extent to which changes promoted by SFPs are or need to be interdependent. The first set of questions focused on six change variables: enrollment ratios, school attendance rates, wastage rates, intellectual development, academic achievement, and nutritional status. This new issue seeks to identify which (if any) of these variables is necessary (and/or sufficient) to promote change in the other variables under consideration. Examples of probing hypotheses that might constitute the research agenda in this area include the following:

1. For what segments of the school population is improvement in nutritional status a necessary and/or sufficient condition for increased cognitive development and improved academic achievement? For what segments of the school population is alleviation of temporary hunger without nutritional status change a necessary and/or sufficient condition for improved academic performance?

2. For what segments of the school population is improvement in nutritional status a necessary and/or sufficient condition for improved school attendance rates? For what segments of the school population is alleviation of temporary hunger alone a necessary and/or sufficient condition for improved school attendance?

3. To what extent are changes in enrollment ratios and wastage rates dependent on changes in nutritional status? Can the alleviation of temporary hunger alone contribute to change in these areas?

Matching the design characteristics of an SFP to a particular set of ecological conditions is the final concern on which an operations research project ought to focus. Some probing hypotheses related to this issue and especially suited for inclusion in a research agenda include the following:

1. For what settings would breakfast, lunch, snack, or some combination of these feedings (e.g., breakfast and lunch) be most appropriate?

2. In what settings should feeding be integrated with a cognitively oriented intervention?

3. In what settings should the feeding program attempt to close the gap between average daily intake and minimum daily requirements? Where should the program attempt only to alleviate temporary hunger?

If this list of probing hypotheses constitutes the outline of an agenda for an operations research project, then attention must now be given to methodological issues, including overall approach, sample selection, and modes of analysis. What follows is a broad discussion of each of these topics.

To provide responses to the probing hypotheses noted earlier, an operations research project on SFPs must have three important characteristics. First, it should be longitudinal; rate of change over time needs to be measured. Second, it should assess the impact of alternative designs in a variety of ecological settings. Last, at least some of the designs tested ought to incorporate a cognitive component in order to assess potential impact for "state of the art" programming.

The operation research project proposed here would be of a 3- to 5-year duration; would involve a wide variety of sites in one country; and would track first graders in relation to attendance, wastage, academic achievement, and nutritional status. In addition, data on enrollment ratios would be gathered for the length of the study. Ideally, the study would monitor the first grade cohort for the same number of years as covered by the primary school curriculum. However, because the bulk of attrition generally takes place by the end of the third grade, it is probable that a shortened study period, although not preferable to one that coincides with the primary school cycle, would be adequate for discerning most of an SFP's impact on the variables under consideration.

Seven basic treatment programs would be tested: snack only, breakfast only, lunch only, snack plus cognitive intervention program, breakfast plus cognitive intervention program, lunch plus cognitive intervention program, and cognitive intervention program only. A "no treatment" control group would also be included in the design.

For the cognitive intervention program to be replicable and appropriate to a wide cross-section of teachers in developing countries, it must be easy to use and free from any dependence on materials that are expensive or difficult to obtain. For the purposes of this project, a flashcard program of games built around the alphabet, numbers, and vocabulary items matched with pictures seems highly appropriate. These games would be teacher-led, last an average of 15 minutes daily, and, insofar as possible, be played in conjunction with the meal or snack activity. As students advanced beyond the first grade, the games would, of course, become increasingly complex and could involve small groups of student players working independently of one another. Of course, a modest teacher training program would be needed to mount the flashcard program.

Each of the seven treatments would be tested in four different types of settings to assess how program ecology acts as a mediating variable. These settings would be ranked from "most favorable" to "least favorable" through the construction of three indices, one for socioeconomic status, one for the quality of the education available, and one for nutritional status. It is expected that the "most favorable" environments would be placed between the 51st and 65th percentiles on each index, whereas the "least favorable" would fall below the 20th percentile on all indices for which the frame of reference is a representative sample of schools within the target country. In operational terms, a school would be placed in a given category if at least 60 percent of the first graders fell within the specified ranges and if the majority of the remaining students fell within ±10 percentile units of the specified ranges.

The socioeconomic status index would be constructed to include family income; education of father; education of mother; physical characteristics of the family dwelling (e.g., number of rooms, presence or absence of latrines, roofing material); and presence or absence of key possessions (e.g., radio, bed, chair). The quality of education index would reflect teacher qualifications and school facility characteristics. Measures of teacher background include highest grade completed and years of teacher experience. School plant adequacy would be reflected in the ratio of total enrollment to number of school desks, the ratio of total enrollment to books in school, lighting, and occupancy density (number of students per square foot of classroom space). Student-teacher ratio would also be included in this index, along with the ratio of first graders to students enrolled in the last year of primary school. The nutritional status index would be a simple comparative measure of weight for height.

In Table 3, characteristics of the various ecological settings and the distribution of treatment programs are summarized. It shows that the proposed project involves four distinct ecological settings, seven different experimental treatments, and a total of 88 research sites. This relatively large number of sites is needed to ensure an appropriate mix of rural and urban schools as well as an adequate number of first grade subjects. Each cell in Table 3 will include one urban school; the remainder will be rural. A sample of this size will also facilitate comparisons of impact on the basis of program exposure (i.e., the number of days the program was actually in operation at the school site) and differential program impact on boys and girls. It is expected that schools with fewer than 20 first grade students would be eliminated from the sample because of the longitudinal nature of the study and the need to have a reasonable number of subjects in the study's concluding phase.

It is recommended that both the breakfast and lunch programs be designed, insofar as possible, to provide students with approximately 30 percent of their minimum daily nutritional requirements. This may well involve the supplementation of donated commodities. The snack ration should contain approximately one-half the nutritional value of the breakfast or lunch programs and should be served mid-morning. Periodic data on the food consumption habits of the students should be gathered to determine the degree to which the SFP is alleviating temporary hunger and the extent to which it promotes supplementation of the current diet or the substitution of SFP products for normally consumed foods.

Table 3. Sample Construction of Operations Research Project on SFP Impact

Setting	Percentile Rankings on All 3 Indices	Snack Only	Breakfast Only	Lunch Only	Snack + Cognitive Treatment	Breakfast +Cognitive Treatment	Lunch + Cognitive Treatment	Cognitive Treatment Only	No Treatment	Total
Most Favorable	51st-65th	2	2	2	2	2	2	2	2	16
Moderately Favorable	35th-50th	3	3	3	3	3	3	3	3	24
Moderately Unfavorable	20th-34th	3	3	3	3	3	3	3	3	24
Most Unfavorable	Below 20th	3	3	3	3	3	3	3	3	24
TOTALS		11	11	11	11	11	11	11	11	88

In Section 2 of this report, the path analysis techniques used by the Checchi team in its three-country study of SFPs were reviewed. It was noted that a strength of this approach is that it provides a framework for testing the "fit" between the assumptions inherent in the design of an SFP and the actual conditions found in the field. This is achieved by enabling researchers to examine where the largest number of "incorrect paths" (i.e., unanticipated cause-and-effect linkages) lie. Given the nature of the operations research project proposed here--an attempt to match a variety of ecological settings to alternate intervention designs--this approach seems most appropriate.

Data analysis will, of course, need to focus on more than how each intervention's impact differed according to the ecological setting in which it was tested. Comparisons will also have to be made that point up differences in impact between boys and girls, rural and urban students, relatively younger and older first graders, and students with more versus less exposure to the program (as determined by the number of days the SFP actually was operational at the study site).

Table 4 provides the results of an analysis of several of the probing hypotheses related to each of the three issues proposed for consideration. The analysis includes the relevant independent and dependent variables, operational definitions, and the kind of instrumentation needed to investigate them. These examples are offered to illustrate the breadth and complexity of the proposed operations research project, as well as the wealth of invaluable information that would be generated through such an effort.

One question remains: Is such a complex and presumably costly research effort worthwhile? The savings that will stem from a more cost-effective intervention program will undoubtedly justify the initial investment many times over. Food is a valuable resource. Our country has a responsibility to see that the essential dilemma of foreign aid--the tension between what donor nations are willing to give and what recipient nations actually want--is resolved in a way that results in a positive sum game where all parties gain. With school feeding programs, this dilemma is minimized, because it is one of a relatively small number of programs that can satisfy objectives of a broad range of constituencies, from the U.S. farmer to the developing country planner. As such, it appears to be the embodiment of win-win gamesmanship. Every effort must be made to assure ourselves and our developing country partners that this appearance is firmly rooted in fact. Otherwise, both donor and recipient nations alike will become losers in the struggle to create conditions favorable to global peace and security.

Table 4. Selected Examples of Probing Hypotheses For an Operations Research Project on School Feeding Programs

Probing Hypotheses	Independent Variables	Intervening Variables	Dependent Variables	Operational Definitions	Instrumentation	Comments
1) Do SFPs lead to positive changes in school enrollment ratios? What are the characteristics of those students for whom SFPs do and do not constitute an inducement to enroll? Are SFPs effective in promoting enrollment among students deemed to be most vulnerable to nutrition-related problems?	SFP (presence or absence) SFP (intervention mode) SFP (efficiency)	Nutritional status Nutrition-related vulnerability Student background factors School background factors	School enrollment ratio	a) SFP = snack, breakfast, or lunch program served in school using a combination of donated commodities and locally purchased products, or relying solely on one or the other. Breakfasts or lunches provide approximately 30 percent of MDR; snacks offer half this amount. b) School enrollment ratio = the proportion of students in a specified age cohort who are currently enrolled in school. c) Nutrition-related vulnerability = children at or below the 90th percentile of weight-for-height or height-for-age norms and children from families with one or more of the following characteristics: rural and landless, one or both parents absent, economically marginal (below the 30th percentile in real income), ethnic minority. SFP intervention mode = one of the following: breakfast only; lunch only; snack only; and each	a) SFP Control Sheet: to monitor content, frequency, and participation in SFP. b) Census Form: to determine size of cohort. c) Enrollment Data Sheet: to derive data on school enrollment from which enrollment ratios can be calculated. d) Student Case History Form: to assess the student background factors and degree of nuitrition-related vulnerability. e) School Background Factor Scale: to record and assess teacher qualifications and school plant adequacy. f) Student Height-Weight Chart: form to monitor changes in weight-for-height over time. Nutritional status comparison of weight-for-height with locally or internationally accepted norms.	Changes in school enrollment ratios will be correlated with each of the following variables: type of SFP; nutritional status of students; degree of nutrition-related vulnerability; student background factors school background factors nutritional status changes within students and SFP efficiency and intervention mode. These correlations will be derived periodically throughout the study period commencing with a baseline measure administered to first graders. Regression analysis will be used to identify the proportion of variance attributable to each of the independent and intervening variables.

Table 4. Selected Examples of Probing Hypotheses
For an Operations Research Project on School Feeding Programs (cont.)

Probing Hypotheses	Independent Variables	Intervening Variables	Dependent Variables	Operational Definitions	Instrumentation	Comments
1. (cont.)				of the above combined with a cognitive intervention consisting of 15 minutes a day of structured games using flashcards with numbers, letters, and vocabulary items. SFP efficiency = $\frac{\text{No. of program days}}{\text{No. of school days}}$	g) Student Background Factors Scale: sex of student; family SES as reflected by the education of child's father and mother; physical characteristics of the family dwelling; and absence or presence of targeted possesions including a radio, bed, and chair; student IQ as measured by Raven. h) School background Factors Scale: qualifications of teaching staff (e.g., highest grade completed; number of years teaching); school plant adequacy as measured by ratio of total enrollment to number of desks and books; occupancy per square foot of space and adequacy of illumination; pupil-teacher ratio and average wastage rate between first and last year of primary cycle.	

Table 4. Selected Examples of Probing Hypotheses For an Operations Research Project on School Feeding Programs (cont.)

Probing Hypotheses	Independent Variables	Intervening Variables	Dependent Variables	Operational Definitions	Instrumentation	Comments
2) Do SFPs lead to improvements in school attendance among enrolled students? What are the characteristics of those students for whom SFPs do and do not constitute an inducement to attend? Are SFPs effective in promoting attendance among students deemed to be most vulnerable to nutrition-related problems?	SFP (presence or absence) SFP (intervention mode) SFP (efficiency)	Nutritional status Nutrition-related vulnerability Student background factors School background factors	School attendance rate	School attendance rate = average daily attendance for 50 preselected days. Days preselected would not be contiguous to a weekend, holiday, or vacation period and would be seasonally stratified. See #1 for other terms.	All instruments noted in #1 and Student Attendance Form to record attendance as well as enrollment on preselected days.	Changes in attendance will be correlated with the same variables and analyzed in the same manner as described in #1.
3) Do SFPs lead to reductions in the wastage rate? What are the characteristics of those students for whom SFPs do and do not constitute an inducement to complete primary school in the prescribed number of years? Are SFPs particularly effective in reducing the wastage rate among students deemed to be most vulnerable to nutrition-related problems?	SFP (presence or absence) SFP (intervention mode) SFP (efficiency)	Nutritional status Nutrition-related vulnerability Student background factors School background factors	Wastage rate	Wastage rate for a primary school curriculum of 5 years = Number of students enrolled in the fifth grade in y^5 divided by the number of students who entered first grade in y^1, where y^1 = base year + 5. Intermediate wastage rates can be calculated for $y^2 - 4$ using this same approach.	See #1	Changes in wastage rate (y^2-y^5) will be correlated with the same variables and analyzed in the same manner as described in #1.
4) Do SFPs contribute to a student's increased ability to engage in cognitive processes closely associated with learning? What are the specific cognitive processes most amenable to change through a school feeding intervention? What are the characteristics of those students particularly benefited by SFPs in the area of cognitive development? Are SFPs particularly effective in promoting cognitive	SFP (presence or absence) SFP (intervention mode) SFP (efficiency)	Nutritional status Nutrition-related vulnerability Student background factors School background factors	Cognitive development	Cognitive development = ability to concentrate and attend to instruction; ability to retain information in the short- and long-term; ability to integrate stimuli and information obtained through various sensory modes.	Scale of Ability to Attend to Instruction*: Students are individually given sequences of directives and tested on their ability to follow directions of increasing length and complexity. Example: Put the ball on the book (two behavioral steps, no qualifiers).	Test scores will be correlated with with each other as well as with the same variables and analyzed in the same manner as described in #1. * Tests to be specially developed for this project.

Table 4. Selected Examples of Probing Hypotheses
For an Operations Research Project on School Feeding Programs (cont.)

Probing Hypotheses	Independent Variables	Intervening Variables	Dependent Variables	Operational Definitions	Instrumentation	Comments
4) (Cont.) development among students deemed to be most vulnerable to nutrition-related problems?					Put the red ball on the book (two behavioral steps, one qualifier). Put the red ball on the blue book (two behavioral steps, two qualifiers). Short-term Memeory Test*: An individually administered test in which students are asked to duplicate number, word, and picture sequences presented by tester. Long-term Memory Test*: Essentially the same test as above except that students duplicate each sequence after 90 seconds of an intervening activity. Portius Maze Test: Although originally designed as an IQ test, the items can be administered in an untimed fashion and scored somewhat differently so that eye-hand coordination difficulties do not influence assessment. If these adjustments are made, this instrument will measure foresight, ability to plan, attention, and inter-sensory capacity. See also intrumentation on items #1-3.	

Table 4. Selected Examples of Probing Hypotheses
For an Operations Research Project on School Feeding Programs (cont.)

Probing Hypotheses	Independent Variables	Intervening Variables	Dependent Variables	Operational Definitions	Instrumentation	Comments
5) Do SFPs contribute to improvements in student academic performance? What are the characteristics of those students whose academic peformance appears to benefit from the presence of an SFP? Are SFPs effective in improving the academic peformance of students deemed to be most vulnerable to nutrition-related problems?	SFP (presence or absence) SFP (intervention mode) SFP (efficiency)	Nutritional status Nutrition-related vulnerability Student background factors School background factors	Student academic performance	Student academic performance = ability ability to perform essential school-related tasks as evidenced by scores on standardized tests and normal progress through a school system (i.e, 1 year of academic credit for each year spent in school)	Boehm Test of Basic Concepts for first and second graders; math and vocabulary portion of test similar to Stanford or Metropolitan Achievement Tests (i.e., instrument with multilevels) adapted for local use. See also instrumentation in items #1-4.	Changes in school performance as measured by appropriate achievement test and academic progress will be correlated and analyzed in the same manner as described in #1. The Boehm Test of Basic Concepts measures essential concepts needed by children to cope with classroom instruction. It correlates highly with a child's ability to learn reading and math/facts. It contains 50 basic relational concepts (e.g., same/different, right/left; more/less; first/last).
6) For what segments of the school population is improvement in nutritional status a necessary and/or sufficient condition for improved cognitive development and academic achievement? For what segments of the school population is alleviation of temporary hunger without nutritional status change a necessary and/or sufficient condition for improved academic performance?	Nutritional status Alleviation of temporary hunger	Student background factors School background factors	Level of cognitive development Student Academic performance	See #4 and #5	See #4 and #5 Food Consumption Habits Inventory: record designed to measure food intake of students over a 24-hour period. It is especially sensitive to the quantity of food consumed prior to participation in an SFP by recording time and level of intake.	Changes in nutritional status will be correlated with changes in cognitive development and academic achievement. These changes will be derived periodically over life of study, commencing with a baseline measure. Likewise, presence or absence of hunger will be correlated with changes in

Table 4. Selected Examples of Probing Hypotheses
For an Operations Research Project on School Feeding Programs (cont.)

Probing Hypotheses	Independent Variables	Intervening Variables	Dependent Variables	Operational Definitions	Instrumentation	Comments
6) (Cont.)						student academic performance. Regression analysis will be used to identify the proportion of variance attributable to each independent and intervening variable.
7) In what settings would breakfast, lunch, snack, or some combination of these feedings be most appropriate?	SFP intervention mode (breakfast only, lunch only, snack only) SFP efficiency	Student background factors School background factors	Student enrollment ratios School attendance rate Nutritional status Level of cognitive development Student academic performance	See items #1 - #5.	See item #1 for descriptions of SFP Control Sheet, Census Form, Enrollment Data Sheet, Student Case History Form, School Background Factors Scale, and Student Background Factors Scale, and see items #4 and #5 for remaining instrumentation.	SFP intervention mode will be correlated with each of the dependent variables while controlling for the intervening variables. Regression analysis will be used to identify the proportion of variance attributable to each intervening variable.
8) In what settings should feeding be integrated with a cognitively oriented intervention?	SFP intervention mode (breakfast only, snack only, lunch only, or any of the above plus cognitive intervention) SFP efficiency	Student background factors	School enrollment ratios School attendance Level of cognitive development Student academic performance Nutritional status	Same as previous item	Same as previous item	Same as previous item

BIBLIOGRAPHY

Amundson, Wallace, and Barry Wecker. *SAWS Rwanda Evaluation, School Lunch Feeding Project, Prefecture of Gikongoro*. Washington, D.C.: USAID, 1982.

Anderson, Carrel M., and Raymond Schaffer, Jr. "The Case for a Quality Nutrition Program in the Public Schools." *Phi Delta Kappan* 62, 2 (October 1981).

Anderson, Mary Ann, and Tina Grewel, eds. *Nutrition Planning in the Developing World*. New York: CARE, 1976.

Balderston, Judith, Alan Wilson, Maria Freire, and Marie Simonen. *Malnourished Children of the Rural Poor*. Boston: Auburn House Publishing Company, 1981.

Barnes, R.H., A.U. Moore, I.M. Reid, and W.G. Pond. "Effect of Food Deprivation on Behavioral Patterns." In *Malnutrition, Learning and Behavior*. Edited by Nevin Scrimshaw and John Gordon. Cambridge, Massachusetts: MIT Press, 1968.

Birch, H.G., and J.D. Gussow. *Disadvantaged Children--Health, Nutrition and School Failure*. New York: Harcourt Brace and World, Grune and Stratton, 1970.

Blumenfeld, Stuart. *PL 480 Title II: A Study of the Impact of a Food Assistance Program in the Philippines*. Manila, Philippines: USAID, August 1982.

Calloway, Doris Howes, Christina Wood, Robin D. Beall, and Dorothy J. Cattle. *Collaborative Research Support Program on Intake and Function*. Berkeley, California: University of California, May 31, 1980.

CARE. *An Evaluation of the School Feeding Program in India*. India: CARE, July 1975.

______. *Mid-Day Meals Programme in Madhya Pradesh; A Study of Impact on Tribal School Children*. New Delhi: CARE, 1979.

______. "School Feeding in Karnataka: Impact on Enrollment and Attendance." India: CARE, 1977 (unpublished report).

______. *Sri Lanka Primary School Nutrition Survey*. Sri Lanka, CARE, 1981.

______. *The Nutritional Impact of Nutribun Feeding: An Evaluation in Forty-Five Elementary Schools*. Philippines: Department of Education and Culture, 1974-1975.

Catholic Relief Services. *Whither Title II: A Contribution to Food for Peace PL 480 Title II Evaluation*. Nairobi, Kenya: Catholic Relief Services, Africa Regional Office, 1980.

_____. "Comments on the AID Evaluation of the Title II Country Program in Upper Volta." New York: Catholic Relief Services, 1981.

Chambliss, Martha, and Charles Parham. "The Effects of a Breakfast Program on Reading Achievement of Elementary School Children." *Educational Resources Information Center (ERIC)*. University of Mississippi, 1978.

Chandrasekhar, Usha, and M. Amirthaveni. "The Impact of School Lunch Programmes on Physical Development, Mental Ability, and Certain Behavioral Aspects of Selected Primary School Children." *The Indian Journal of Dietetics*, 1976, 13.

Chavez, Adolfo, Celia Martinez, and Tamara Yaschine. "The Importance of Nutrition and Stimulation in Child Mental and Social Development." In *Early Malnutrition and Mental Development*. Edited by Joaquin Cravioto, Leif Hambraeus, and Bo Vahlquist. Uppsala, Sweden: Almquist I. Miksell, 1974, pp. 211-225.

Checchi and Company. *Final Report: Evaluation Methods of Child Feeding Projects in Developing Countries*. Chapter IV, "An Analysis of Pilot Study Survey Data in Three Countries". Washington, D.C.: Checchi and Company, March 1977.

_____. *Food for Peace--An Evaluation of PL 480 Title II*. Vol. I, *A Global Assessment of the Program*. Washington, D.C.: Checchi and Company, July 1971.

_____. *Food for Peace--An Evaluation of PL 480 Title II*. Vol. II, *Evaluations of Eight Country Programs*. Washington, D.C.: Checchi and Company, July 1971.

Clapp and Mayne, Inc. *Evaluation of PL 480 Title II Feeding Programs in Honduras*. San Juan, Puerto Rico: Clapp and Mayne, Inc., 1977.

Cochrane, Susan, Donald O'Hara, and Johanna Leslie. *The Effects of Education on Health*. World Bank Staff Working Paper No. 405. Washington, D.C.: World Bank, July 1980.

Committee on School Lunch Participation. *Their Daily Bread: A Study of the National School Lunch Program*. New York: Committee on School Lunch Participation, 1968.

Community Systems Foundation. *Final Report: Analysis of Community Level Nutrition Programs in India*. Ann Arbor, Michigan: Community Systems Foundation, October 1980.

Cotten, Joel. *Evaluation Research on the PL 480 Title II School Feeding Program in Haiti*. Port-au-Prince, Haiti: USAID, February 1982.

Drake, William D., John Gunning, Abraham Horwitz, Roy Miller, Harold Rice, and Gnani Thenabader. *Final Report: Nutrition Programs in Sri Lanka Using U.S. Food Aid (An Evaluation of PL 480 Title II Programs)*. Ann Arbor, Michigan: Community Systems Foundation, March 20, 1982.

Dwyer, Johanna. "An Experimental Breakfast Program: Acceptance and Some Aspects of Classroom Performance." Paper presented at a VIB seminar on the Ecology of Dysnutrition, New York, November 1, 1972.

Ellis, Richard, Diane Cleemput, and Mark Cooper. *Child Feeding Programs in Developing Countries: A Comparative Evaluation of Ongoing Programs in Colombia, Kenya, and the Philippines--Interim Report*. Washington, D.C.: Checchi and Company, July 1974.

______. *Child Feeding Programs in Developing Countries: A Comparative Evaluation of Ongoing Programs in Colombia, Kenya, and the Phillippines*. Annex A and B. Washington, D.C.: Checchi and Company, August 22, 1974.

______. *Judging the Merit of Child Feeding: A Development Handbook*. Washington, D.C.: Checchi and Company, September 1975.

Emmons, L., M. Hayes, and D.L. Call. "A Study of School Feeding Programs. 2. Effects on Children With Different Economic and Nutritional Needs." *Journal of American Dietetics Association* 61 (1972): 268.

Food and Agriculture Organization (FAO). *Food and Nutrition Education in the Primary School*. FAO Nutritional Study No. 25. Rome: FAO, 1971.

Food Research and Action Center. *If We Had Ham, We Could Have Ham and Eggs...If We Had Eggs: A Study of the National School Breakfast Program*. The Food Research and Action Center, 1972.

French, Arthur, Christopher J. Roesel, and Simon J. Shich. "An Assessment of the Conduct of the Expanded Food and Nutrition Education Program in Selected Sites." Rosslyn, Virginia: Interamerica, June 1981 (unpublished report for Science and Education Administration, U.S. Department of Agriculture).

Gall, Pirie, James Eckroad, and J. David Stanfield. "Final Draft Report: Evaluation of the PL 480 Title II Program in the Dominican Republic." Annexes. Washington, D.C. and Ann Arbor, Michigan: International Science and Technology Institution, Inc., and Community Systems Foundation, August 1982.

_____. "Final Draft Report: Evaluation of the PL 480 Title II Program in the Dominican Republic." Washington, D.C. and Ann Arbor, Michigan, International Science and Technology Institute, Inc. and Community Systems Foundation, August 1982 (unpublished report for USAID).

Ghassemi, H., and G.E. Beaton. "Supplementary Feeding Programmes for Young Children in Developing Countries," Toronto and New York: University of Toronto and Tehran University, October 1979 (unpublished report for UNICEF and ACC Subcommittee on Nutrition of the United Nations).

Gilmore, Judith W, Carol C. Adelman, J. Anthony Meyer, and Melvyn C. Thorne, Morocco: Food Aid and Nutrition Education. Washington, D.C., Agency for International Development, August 1980.

Goldsmith, Robert H. "Nutrition and Learning," Educational Resources Information Center (ERIC) ED 196522. Bloomington, Indiana: Phi Delta Kappa, 1980.

Gopaldas, Tara, et al. Project Poshak. Vols. I and II: An Integrated Health-Nutrition Macro Pilot Study for Preschool Children in Rural and Tribal Madhya Pradesh. New Delhi: CARE, 1975.

Gorecki, Margaret. "Nutritional Evaluation of the School Feeding Program, Preliminary Report--Honduras." CARE, June 9, 1978 (unpublished report).

Gunderson, G. W. The National School Lunch Programs--Background and Development. FNS-63. Washington, D.C.: U.S. Department of Agriculture, 1971.

Gussow, Joan. "Bodies, Brains, and Poverty: Poor Children and the Schools." Educational Resources Information Center (ERIC). IRCD, VI, 3 (1969 ?):3-4, 9-14.

_____. "Nutrition and Mental Development." Education Resources Information Center (ERIC). IRCD Urban Disadvantaged Series. February 1974. No. 36.

_____. "The Educational Effects of Nutrition." In Beyond the School: What Else Educates? Edited by Kenneth Hansen. Bellaire, Michigan: Chief State School Officers, 1977, pp 37-53.

Hindustan, Thompson Associates, Limited. "A Study of Food Habits in Calcutta." USAID, November 1972 (unpublished report).

Hunt, I. F. "Impact of a School Breakfast Program on the Daily Nutrient Intakes of School Children in a Black Ghetto Area of Los Angeles." Paper presented to the IX International Congress of Nutrition, Mexico City, September 1972.

Hunt, I.F., H.M. Lieberman, M.E. Swendseid, A.H. Coalson, V.A. Clark, and N. Ostergaard. "Nutrient Intakes of Children and the Effect of a School Breakfast Program." (unpublished data).

International Science and Technology Institute, Inc. "Upper Volta Food for Peace/Title II Evaluation Final Report." Washington, D.C: AID Office of Food for Peace, September 1981 (unpublished report for USAID).

Irwin, Marc, Patricia L. Engle, Charles Yarbrough, Robert E. Klein, and John Townsend. "The Relationship of Prior Ability and Family Characteristics to School Attendance and School Achievement in Rural Guatemala." *Child Development* 49 (June 1978): 415-427.

Jelliffe, D.B. *The Assessment of the Nutritional Status of the Community.* World Health Organization Monograph Series No. 53. 1966.

Jones, Earl, et al. *Evaluation of Title II: Food for Peace in Ghana.* Washington, D.C.: Development Associates, Inc., September 1981.

Kanno, Nellie B. "Effect of School Feeding Schemes Upon Learning Among Primary School Children in Lesotho." Ph.D. dissertation, Michigan State University, 1973.

Kar, Barbara. "Nutrition Research Profile: India." New Delhi: USAID, February 27, 1968 (unpublished report).

Knudsen, Odin K. *Economics of Supplemental Feeding of Malnourished Children: Leakages, Costs, and Benefits.* World Bank Staff Working Paper No. 451. Washington, D.C.: World Bank, April 1981.

Kreitzman, S.N. "Evaluation of Craddock Breakfast Study." Atlanta: School of Dentistry, Emory University, 1973, (unpublished).

Lachance, Paul A. "Impressions Concerning Child Nutrition Programs of Developed and Developing Countries." *School Food Service Research Review* IV, 1 (Winter 1980): 13ff.

Latham, Michael C., and Francisco Cobos. "The Effects of Malnutrition on Intellectual Development and Learning." *American Journal of Public Health* 61 (July 1971): 1307-1324.

Leonard, Rodney E. *Why Child Nutrition Programs Fail*. Washington, D.C: The Children's Foundation, 1969.

Lieberman, Harry M., I.F. Hunt, A.H. Coulson, M.E. Swendsied, and L., Ho. "Evaluation of a Ghetto School Breakfast Program." *Journal of the American Dietary Association* 68 (February 1976): 132-138.

McKay, H.E., H. McKay, and L. Sinisterra. "Behavioral Intervention Studies With Malnourished Children: A Review of Experiences." In David J. Kallen, ed., *Nutrition, Development and Social Behavior*. Proceedings of the Conference on the Assessment of Tests of Behavior, from Studies of Nutrition in the Western Hemisphere. Department of Health, Education and Welfare Publication No. (NIH) 73-242. Washington, D.C.: U.S. Government Printing Office, 1973.

Miller, Roy I. "Internal Report 1: Preliminary Results of School Feeding/Attendance Study: Sri Lanka." Washington, D.C.: USAID, July 2, 1982.

Montague, Joel. "School Feeding in Developing Countries: An Overview of Program Activity and Problems as Perceived by CARE Staff Abroad." *The Journal of School Health* XLIII, 6 (1973): 35-356.

Moock, Peter, and Joanne Leslie. *Childhood Malnutrition and Schooling in the Terai Region of Nepal*. Washington, D.C.: International Bank for Reconstruction and Development, 1983.

Morton, Beecher Edward, Jr. "A Study in the Education Aspects of the School Lunch Program in South Carolina." Ph.D. dissertation, George Peobody College for Teachers, 1960.

Myers, Madge L., Sheila C. O'Brien, Judith A. Mabel, and F.J. Stare. "A Nutrition Study of School Children in a Depressed Urban District. 1. Dietary Findings." *Journal of the American Dietetic Association* 53 (September 1968): 226-223.

Nelson, Kathryn, Joyce Vermeersch, Lawrence Jordan, Jean Wellisch, and Steven Gale, eds. *The National Evaluation of School Nutrition Programs*. Vols. I & II. Santa Monica, California: Systems Development Corporation, April 1981 (report for U.S. Department of Agriculture).

Pollitt, Ernesto, Mitchell Gersovitz, and Marita Garguilo. "Educational Benefits of the United States School Feeding Program: A Critical Review of the Literature." American Journal of Public Health 68 (May 1978): 471-481.

Popkin, Barry, and Marisol Lim-Ybanez. "Nutrition and School Achievement." Social Science and Medicine (1981).

Pyle, David F. "Framework for Evaluation of Health Sector Activities by Private Voluntary Organizations Receiving Matching Grants." Washington, D.C. Agency for International Development, n.d.

Rewel, Jack, and Raj Bhatia. Mid-Day Meals Programme: An Evaluation of Impact on Tribal School Children in Madhya Pradesh. India: CARE, 1979.

Richardson, S.A. "Ecology of Malnutrition: Non-Nutritional Factors Influencing Intellectual and Behavioral Development." Nutrition, the Nervous System, and Behavior, 1972.

Robert R. Nathan Associates, Inc. An Evaluation Report of the PL 480 Title II Program in Sri Lanka. Washington, D.C.: Robert R. Nathan Associates, Inc., May 23, 1978.

Rosenzweig, Mark, and Mark Bennet. "How Plastic is the Nervous System?" In The Comprehensive Handbook of Behaviorial Medicine. New York: SP Medical and Scientific Books, 1980.

Rothschild, Emma. The New York Times Magazine 15 (March 13, 1977): 43-48.

Roy, P., and R.N. Rath. School Lunch in Orissa. New Delhi: Council for Social Development, 1970.

Sahn, David. "Principles and Guidelines for the Evaluation of PL 480 Title II (Food for Peace) Programs and Policies. Ann Arbor, Michigan: Community Systems Foundation, October 1, 1981.

Sahn, David E., and Robert M. Pestronk. A Review of Issues in Nutrition Program Evaluation. Ann Arbor, Michigan: Community Systems Foundation, July 1981.

Sahn, David, Beatrice L. Rogers, and David P. Nelson. "Assessing the Uses of Food Aid: PL 480 Title II in India." Ecology of Food and Nutrition 10, 3 (October 1980): 153-161.

Scrimshaw, N. S., and E. Gordon, eds. Malnutrition, Learning and Behavior. Cambridge, Massachusetts: MIT Press; 1968.

Selowsky, Marcelo. The Economic Dimensions of Malnutrition in Young Children. Staff Working Paper No. 294. Washington, D.C.: International Bank for Reconstruction and Development, October 1978.

_____. "Nutrition, Health, and Education: The Economic Significance of Complementarities at Early Ages" Paper presented at International Economic Association Congress, Mexico City, August, 1980.

Srinivasan, T.N. Malnutrition: Some Measurement and Policy Issues. World Bank Staff Working Paper No. 373. Washington, D.C.: World Bank, February 1980.

Systems Development Corporation. Student Background Checklist: School Nutrition Study. Santa Monica, California: Systems Development Corporation, 1981.

_____. Student Packet: School Nutrition Study. Santa Monica, California: Systems Development Corporation, 1981.

Tseng, Rose Y., et al. "The Relationship Between Nutrition and Student Achievement, Behavior and Health: A Review of the Literature." Educational Resources Information Center (ERIC). ED 196547. Sacramento, California: State Department of Education, 1980.

Tuttle, W.W., K. Daum, R. Larsen, J. Salzano, and L. Roloff. "Effect on School Boys of Omitting Breakfast." Journal of American Dietetics Association 30 (1954): 674.

U.S. Department of Agriculture. "U.S. Department of Agriculture's Response to Senate Resolution 90." Washington, D.C.: USDA, May 4, 1981.

Weinberg, Warren, Susan Dietz, Elisabeth Pernick, and William McAlister. "Intelligence, Reading Achievement, Physical Size, and Social Class." Journal of Pediatrics 85, 4 (1974): 482-489.

Special Bibilography on Literature Related to Raven Progressive Matrices

Abul-Hubb, Dhia. Chapter 24, "Application of Progress Matrices in Iraq." Mental Tests and Cultural Adaptation. Cronbach, L.J. and P.J.D. Drenth, eds. The Hague, Netherlands: Mouton Publishers, 1972, pp. 233-235.

Burke, Henry R. "Raven's Progressive Matrices: Validity, Reliability, and Norms." Journal of Psychology 82, 2 (November 1972): 253-257.

Bortner, Morton. "Progressive Matrices, Review." The Sixth Mental Measurements Yearbook. Edited by Oscar Krisen Buros. Highland Park, New Jersey: The Gryphon Press, 1965, p. 490.

Banks, Charlotte, W.D. Wall, and George Westby. "Progressive Matrices, Reviews." The Fourth Mental Measurements Yearbook. Edited by Oscar Krisen Buros. Highland Park, New Jersey: The Gryphon Press, 1953, p. 314.

Cronbach, L.J. and P.J.D. Drenth. Mental Tests and Cultural Adaptation. The Hague, Netherlands: Mouton Publishers, 1972.

Shipley, Walter, and David Weschler. "Progressive Matrices, Review." The Third Mental Measurements Yearbook. Edited by Oscar Krisen Buros. New Brunswick: Rutgers University Press, 1949, p. 258.